

IN THE UNITED STATES DISTRICT COURT
FOR THE SOUTHERN DISTRICT OF WEST VIRGINIA
AT CHARLESTON

OHIO VALLEY ENVIRONMENTAL
COALITION, INC., WEST VIRGINIA
HIGHLANDS CONSERVANCY, INC., and
SIERRA CLUB,

Plaintiffs,

v.

CIVIL ACTION NO. 2:13-21588

FOLA COAL COMPANY, LLC,

Defendant.

Huntington, West Virginia
June 2, 2015

AMENDED TRANSCRIPT

TRANSCRIPT OF BENCH TRIAL - DAY 2
BEFORE THE HONORABLE ROBERT C. CHAMBERS
UNITED STATES DISTRICT JUDGE

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1 Tuesday, June 2, 2015, at 9:05 a.m. in open court

2 THE COURT: Good morning. Are we ready to proceed?

3 MR. LOVETT: We are, Your Honor.

4 MR. HARVEY: Your Honor --

5 THE COURT: Do you want to deal with your defense
6 exhibits first?

7 MR. HARVEY: Yes, Your Honor. Thank you.

8 Defendants would like to move the admission of Joint
9 Exhibit 17, which is the benchmark, and Defendant's Exhibit
10 19, 38 --

11 THE COURT: Go slow.

12 MR. HARVEY: Sorry. 19, 38, 43, 30, 45, 32, 46, 33,
13 47, 34, 48, 39, 36, and 40.

14 THE COURT: All right. Any objection?

15 MR. BECHER: Your Honor, Mr. Harvey has represented
16 to me that these are the exhibits that were introduced by
17 Dr. Garabrant yesterday. To the extent that they are, I have
18 no objection. I haven't had a chance to double check the
19 numbers, but I don't think there will be any problem. But if
20 you could just give us the opportunity to double check the
21 numbers.

22 THE COURT: All right. All right. Those are
23 consistent with what we have being identified during his
24 testimony. I'm going to go ahead and admit them.

25 If you discover later on that one is something different

1 from those that were discussed in the testimony, you can raise
2 it.

3 MR. BECHER: Thank you, Your Honor.

4 THE COURT: All right. Plaintiffs ready to call
5 their first witness?

6 MR. LOVETT: Yes, Your Honor.

7 Call Dr. Steven Wing.

8 THE COURT: All right. Doctor, if you'll step up
9 here, my clerk will administer the oath and you can take the
10 witness stand.

11 STEVEN WING, PLAINTIFFS' WITNESS, SWORN

12 MR. LOVETT: May I approach, Your Honor?

13 THE COURT: You may.

14 Hold on just a moment.

15 (The Court and court reporter conferred privately off the
16 record.)

17 THE COURT: All right. Let's go ahead.

18 MR. LOVETT: Thank you.

19 DIRECT EXAMINATION

20 BY MR. LOVETT:

21 Q. Dr. Wing, what is your full name for the record, please?

22 A. Steven Bennett Wing.

23 Q. And you have two notebooks there beside you. Would you

24 pick up the notebook that's marked Plaintiffs' Exhibits and

25 turn to Plaintiffs' 72, which I think should be a copy of your

Wing - Direct

1 CV.

2 A. 72 did you say?

3 MR. LOVETT: May I approach, Your Honor?

4 THE COURT: You may.

5 THE WITNESS: It says Plaintiffs' Copy.

6 MR. LOVETT: Okay. Your Honor, for the record, let
7 me note, just so you'll understand too, Dr. Wing is a rebuttal
8 witness for Dr. Garabrant from yesterday. We're going out of
9 order with these two witnesses.

10 THE COURT: Right.

11 MR. LOVETT: And then we'll go back to our normal --

12 THE COURT: I understand. Okay.

13 BY MR. LOVETT:

14 Q. Do you have your CV before you that's Plaintiffs' Exhibit
15 72?

16 A. Yes.

17 Q. Did you prepare this?

18 A. I did.

19 Q. When did you prepare it?

20 A. Earlier this year.

21 Q. Okay. Is it still an accurate reflection of your
22 experience and qualifications?

23 A. Yes.

24 MR. LOVETT: Your Honor, this is the only exhibit I
25 think that we will move for admission. So let me do it before

Wing - Direct

1 I forget and move admission --

2 THE COURT: All right. Any objection?

3 MR. HARVEY: No objection.

4 THE COURT: It's admitted.

5 BY MR. LOVETT:

6 Q. Do you consider yourself an expert in epidemiology?

7 A. Yes.

8 Q. Okay. Have you testified in court before and been
9 qualified as an expert in epidemiology?

10 A. Yes.

11 Q. How many times?

12 A. At trial, I believe twice.

13 Q. And was one of those in federal court?

14 A. Yes.

15 Q. And the other in state court?

16 A. Yes.

17 Q. Okay. How many times have you been hired as an expert
18 witness, as an epidemiologist, in your career?

19 A. Approximately 10 or 12 times.

20 Q. Okay. And have you worked for plaintiffs on all those
21 occasions?

22 A. No.

23 Q. Okay. Now, would you just briefly describe your
24 education, I guess starting with your masters. Do you have a
25 masters from Duke?

Wing - Direct

1 A. I have a masters from Duke in sociology with a
2 specialization in demography.

3 Q. And that was in 1980?

4 A. Correct.

5 Q. And then you have a Ph.D. in epidemiology from the
6 University of North Carolina in Chapel Hill?

7 A. Yes.

8 Q. You received that in 1983?

9 A. That's right.

10 Q. How is it that you went from a masters in sociology to a
11 Ph.D. in epidemiology?

12 A. My work in sociology was in the area of demography, which
13 has -- is one of the root disciplines of epidemiology.

14 Q. What is demography?

15 A. Demography is the study of human populations.

16 Q. Okay. Are there other people that enter the Ph.D.
17 program in epidemiology from undergraduate or masters programs
18 that are not epidemiology-specific?

19 A. Typically that's the case.

20 Q. Does UNC have a graduate program in epidemiology?

21 A. Yes.

22 Q. Does it have an undergraduate program in epidemiology?

23 A. No.

24 Q. And is that unusual?

25 A. No, it's not.

Wing - Direct

1 Q. Okay. Now, you're currently an associate professor in
2 the Department of Epidemiology at UNC at Chapel Hill; is that
3 right?

4 A. Correct.

5 Q. And are you tenured?

6 A. Yes.

7 Q. And how long have you been an associate-tenured
8 professor?

9 A. Since 1995.

10 Q. Okay. Have you published in top-tier epidemiology
11 journals?

12 A. Yes.

13 Q. Approximately how many publications do you have?

14 A. I would say maybe 110 in peer-reviewed journals and
15 perhaps a couple of dozen book chapters.

16 Q. Okay. And what is your area of specialization within
17 epidemiology?

18 A. It's environmental and occupational health.

19 Q. Okay. And what classes do you teach? Let me ask, first
20 of all --

21 A. Yes.

22 Q. -- are they graduate-level courses for the most part?

23 A. I teach graduate-level courses that are for students in
24 public health and medicine and other health science fields.

25 Q. In the Department of Epidemiology?

Wing - Direct

1 A. Yes.

2 Q. Okay. And what courses do you teach, generally?

3 A. I, over the last several years, have taught a class in
4 community-driven epidemiology and environmental justice, a
5 class of epidemiology and public health, environmental
6 epidemiology, occupational epidemiology, and history and
7 philosophy of epidemiology.

8 Q. Okay. So what are your areas of concentration within
9 epidemiology for purposes of publication?

10 A. I have several areas that I've worked on in some detail.
11 For the longest time, beginning in the late 1980s, I've worked
12 on the health effects of exposure to ionizing radiation
13 primarily among workers in the United States nuclear weapons
14 complex.

15 I've also worked on other radiation studies involving
16 environmental exposures.

17 Q. Have you published in that area?

18 A. Yes, I have.

19 Q. About how many articles have you published in that area?

20 A. Maybe several dozen articles.

21 Q. And, again, in top-tier journals?

22 A. Some of them are in top-tier journals. Others are in
23 more specialty medical journals.

24 Q. Okay. And when you do your research and teaching, do you
25 use the tools that Dr. Garabrant testified about yesterday,

Wing - Direct

1 like confounding, causation, and effect modification?

2 A. Those are concepts that I work with routinely in the
3 classes I teach, as well as in conducting the empirical
4 research that is funded by grants or contracts.

5 Q. As I understand your resume, you have sort of two areas
6 of specialization. One is empirical research that you've just
7 described, right?

8 A. Yes.

9 Q. You also testified that you teach history and philosophy
10 of epidemiology, right?

11 A. That's one of the areas, yes.

12 Q. Do you supervise graduate student research?

13 A. I do.

14 Q. And how many graduate students do you have in
15 epidemiology that you're supervising now?

16 A. Currently I have about ten Ph.D. advisees.

17 Q. Okay. Have you taught classes on epidemiological
18 methods?

19 A. Yes, I have.

20 Q. Okay. Have you been a reviewer in peer-reviewed
21 journals?

22 A. Yes.

23 Q. Which ones?

24 A. *American Journal* -- I'll give you some examples.

25 *American Journal of Epidemiology*, *American Journal of*

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1 *Industrial Medicine, American Journal of Public Health,*
2 *Environmental Health, Environmental Health Perspectives,*
3 *Epidemiology, Journal of Epidemiology and Community Health,*
4 *Science of the Total Environment, New England Journal of*
5 *Medicine.*

6 Q. You've been reviewers for all of those journals?

7 A. I've been -- that's about a quarter of the journals that
8 I've reviewed for.

9 Q. And, again, those are among the most reputable journals
10 in your field?

11 A. They are all reputable journals.

12 Q. Okay. Do you keep up with current research and ideas in
13 the field of epidemiology?

14 A. I do.

15 Q. Is that part of your teaching and research
16 responsibilities?

17 A. It certainly is. If I didn't keep up, I would be in
18 trouble with the graduate students in my department.

19 Q. Okay. Now, you have a couple of awards listed. I won't
20 belabor the point, but did you receive in 2011 the Homer
21 Calvert Award and Lecture at the -- from the APHA?

22 A. I did.

23 Q. What is the APHA?

24 A. It's the American Public Health Association, which is the
25 largest public health association in the United States.

Wing - Direct

1 Q. And what was that award and lecture for?

2 A. It was for contributions to environmental health, and it
3 was -- it's given by the Environment Section of the American
4 Public Health Association.

5 Q. Did you also receive the Research Integrity Award in
6 2009?

7 A. I did.

8 Q. And who awarded that?

9 A. That was awarded by the International Society for
10 Environmental Epidemiology.

11 Q. Okay. And lastly, do you have -- and I see several
12 awards from UNC, but is one of them the Bernard Greenberg
13 Award --

14 A. Yes, it is.

15 Q. -- in 2004 for teaching, research, and service?

16 A. Yes, that's correct.

17 MR. LOVETT: Your Honor, I'd move to qualify
18 Dr. Wing as an epidemiologist.

19 THE COURT: All right. I'm satisfied. He can be
20 cross-examined as to his qualifications.

21 BY MR. LOVETT:

22 Q. To prepare for your testimony today, did you read the EPA
23 benchmark on which Dr. Garabrant's testimony was based?

24 A. Yes.

25 Q. Did you also look at the review of the Scientific

Wing - Direct

1 Advisory Board of the benchmark?

2 A. I don't recall the Scientific Advisory Board document.

3 Q. All right. Do you intend to offer opinions on stream
4 ecology here today?

5 A. No, I don't.

6 Q. Can an epidemiologist who is not an expert in stream
7 ecology in your opinion perform the kind of analyses and reach
8 the kinds of conclusions that EPA reached in the benchmark?

9 A. No. I think it's important to have substantive knowledge
10 in the area in which one conducts analyses and draws opinions.

11 Q. Okay. We'll get into that as we move forward.

12 Could an epidemiologist without expertise in the field of
13 stream ecology conduct an analysis of causation in relation to
14 the kinds of things that EPA did in its benchmark?

15 A. Not without knowledge from the field --

16 Q. Why not?

17 A. -- of study. Because science involves more than data
18 analysis. There's an important distinction between a data
19 analyst and a scientist because variables and data don't speak
20 for themselves. They require interpretation and understanding
21 of mechanisms, theories in the field, and so on.

22 Q. Well, I think -- didn't Dr. Garabrant yesterday say just
23 that, the data speak for themselves?

24 A. He -- I may not have used those words precisely, but my
25 interpretation of his testimony was that he was able to draw

Wing - Direct

1 conclusions based on analysis of a dataset.

2 Q. And you believe that you have -- that data doesn't speak
3 for -- data don't speak for themselves, but one has to be
4 informed about some particular subject to be able to interpret
5 those data, right?

6 A. That's my opinion.

7 Q. Okay. Do you understand -- let me ask you, first of all,
8 what is epidemiology?

9 A. Epidemiology at its root epidemiologically is the study
10 of epidemics. And it includes not only infectious disease,
11 although that's its roots, but it now more generally is the
12 study of disease both epidemic and endemic in human
13 populations.

14 Q. Okay. Do you understand the benchmark to be a purely
15 epidemiological analysis?

16 A. No.

17 Q. Okay. And is it appropriate for the benchmark or any
18 kind of scientific causal reasoning to not be specifically an
19 epidemiological analysis?

20 A. Yes.

21 Q. It's common in scientific research, is it not, not to
22 engage in epidemiological system, right?

23 A. Most scientific research is -- if we were to take the
24 body of scientific research and knowledge and classify it into
25 two groups, epidemiology and not epidemiology, the not

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1 epidemiology group would constitute the vast majority of the
2 research and knowledge.

3 Q. So epidemiology is not some super science that is the
4 king of all sciences that can be used to criticize and
5 critique other sciences, correct?

6 A. That's correct.

7 Q. You heard Dr. Garabrant's testimony yesterday, didn't
8 you?

9 A. I did.

10 Q. Can you summarize your understanding of how he approached
11 causal reasoning?

12 A. He approached it as a data analyst, meaning that he
13 approached the topic at hand, the benchmark, as a problem
14 of -- that could be addressed simply by conducting statistical
15 analyses of a single dataset.

16 Q. So it's something that anyone could do who's familiar
17 with statistical and epidemiological tools without any
18 substantive knowledge in the area.

19 A. Well, yes, anyone can analyze data. Whether those
20 analyses result in something that is meaningful and reliable
21 and actually useful in environmental protection or in science
22 or in legal matters, for that matter, is another question.

23 Q. Do you agree or disagree with the approach that
24 Dr. Garabrant took here yesterday?

25 A. Overall --

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1 Q. In terms of causation.

2 A. In terms of causation, I found it to be very much
3 lacking.

4 Q. Okay. Is there a rule or rules in epidemiology that can
5 be used in all cases to determine causation?

6 A. Epidemiology shares with other branches of science the
7 characteristic that it's not a cookbook. It's not a matter of
8 following a recipe which guarantees that you get reliable or
9 valid results if followed.

10 Q. Would you turn to the plaintiffs' notebook, which is --
11 should be in front of you.

12 A. Yes.

13 Q. Tab 167.

14 A. Yes, I have it.

15 Q. Do you have a paper entitled "Scientific Evidence and
16 Public Policy" there?

17 A. Yes.

18 Q. And have you seen this before?

19 A. I have.

20 Q. And who wrote it?

21 A. It was written by an epidemiologist by the name of David
22 Michaels.

23 Q. Does Dr. Michaels have a good reputation in the field of
24 epidemiology?

25 A. He does. He's a professor at George Washington

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1 University and he's currently the Director of the United
2 States Occupational Safety and Health Administration.

3 Q. Okay. And this is published in the *American Journal of*
4 *Public Health*? Is that a flagship journal in the field of
5 public health?

6 A. It's the flagship journal specifically of the American
7 Public Health Association and perhaps the best known general
8 journal in public health.

9 Q. I'm going to ask you to read into the record two
10 quotations and comment on them.

11 The first bottom one is at the first page, and it
12 begins -- the paragraph begins, "Close analysis." Do you see
13 that?

14 A. Yes.

15 Q. Beginning just most of the way through that first column
16 where it says, "no absolute criteria," could you read from
17 that point to the end of the sentence?

18 A. Yes. Dr. Michaels writes, "no absolute criteria exists
19 for assessing the validity of scientific evidence. Scientific
20 reasoning is no more susceptible to a mechanical approach than
21 legal reasoning."

22 Q. Okay. And then let's turn to the next page, page 56, or
23 2146 Bates number, and the paragraph beginning, "Manufacturing
24 Uncertainty."

25 Do you see that?

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1 A. The heading?

2 Q. The heading.

3 A. Yes.

4 Q. Could you read the first sentence into the record from
5 that, please?

6 A. "Magnifying or manufacturing scientific uncertainty is
7 another tactic used to delay or prevent public health and
8 environmental protection."

9 Q. I'm sorry. Continue through --

10 A. "The approach was used with great success by the tobacco
11 industry and other manufacturers of dangerous products; now,
12 it is rare for proposed regulations not to be challenged with
13 claims that the scientific evidence is flawed or otherwise
14 imperfect."

15 Q. Now, do you agree with Dr. Michaels' statement that
16 there's no absolute criteria that exists for validating
17 scientific evidence?

18 A. I do.

19 Q. And I mean, I don't know why Dr. Michaels wrote this, but
20 is a problem in your field generally that people use
21 epidemiological principles to, as he says, manufacture
22 uncertainty?

23 A. It is a general problem, and it's one that arises out of
24 actually teaching in epidemiology such as in a program like
25 the one I'm part of. Students are required to understand the

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1 characteristics of study design and the limitations of designs
2 and the flaws that occur in analysis of data. And one of the
3 problems is that that can become nitpicking or flaw-catching
4 and confused. And the existence of incomplete data or
5 knowledge or minor disagreements about methods can become an
6 excuse for thinking we don't know anything. And that's been
7 exploited for the purpose of preventing environmental and
8 health protections.

9 Q. Okay. Let's move -- what is it -- you heard
10 Dr. Garabrant talk -- testify about effect modification
11 yesterday, right?

12 A. Yes.

13 Q. What is effect modification?

14 A. Effect modification is a term that comes from the field
15 of epidemiology. Other fields deal with the same concept, but
16 they use different terminology.

17 Q. What terminology might other fields use?

18 A. Other fields often use the term "interaction," meaning
19 that -- and the definition is very similar, meaning that the
20 effect of some exposure differs according to some other
21 factor.

22 Q. Okay. And you heard Dr. Garabrant testify yesterday
23 about effect modification, did you not?

24 A. I did.

25 Q. And did you agree with his testimony about the definition

Wing - Direct

1 and use of "effect modification"?

2 A. I think his definition was mostly accurate.

3 Q. Uh-huh.

4 A. I believe his evaluation was not appropriate at all.

5 Q. Why not?

6 A. Because in order to make a decision about interaction or
7 effect modification, it's first necessary to have some idea
8 about the topic one is investigating because without that, one
9 can make egregious mistakes about an analysis which can be
10 done by someone who doesn't know anything about the topic but
11 could result in essentially meaningless conclusions or
12 actually conclusions that are misleading.

13 Q. Dr. Garabrant testified that EPA didn't assess effect
14 modification by any factor or any association that it studied.

15 Do you agree with that? I think he said that was a flaw
16 in the benchmark.

17 A. I believe that the issue of effect modification or
18 interaction is one that should be made based on substantive
19 knowledge in the area, and it's not one that's simply a
20 statistical requirement or rule.

21 Q. Even within the field of epidemiology, there's
22 specialties, right?

23 A. Of course.

24 Q. It's like medicine in that respect.

25 A. In fact, the specialization of areas within epidemiology

Wing - Direct

1 largely follows the specializations in medicine.

2 Q. And you would tread with great care into another area of
3 specialization even within epidemiology; is that true?

4 A. That is true.

5 Q. And if you were to do that, the specialists in that field
6 would be skeptical of your qualifications.

7 Is that your understanding?

8 A. Well, I work in several areas of epidemiology by myself.

9 Q. Right. But if you went outside of those areas into
10 another area of epidemiology --

11 A. Right. And over my career, I have worked in different
12 areas over time.

13 When I move into a new area, I do so gradually and with
14 care and always in close collaboration with people who have a
15 lot of experience in that area.

16 Q. Do you believe it's even more problematic to take
17 epidemiological tools and move them outside of the field of
18 epidemiology into a completely different discipline?

19 A. I think the further one goes from one's substantive
20 knowledge, the more difficulty one would have even if the
21 methods used, for example, in statistics were the same.

22 I could give you an example --

23 Q. Okay.

24 A. -- or an analogy, perhaps, that would be commonly
25 understood. Suppose I was about to take a flight on an

Wing - Direct

1 airplane. I would like to know that the mechanic or the
2 mechanics that checked the airplane were airplane mechanics.

3 Now, if I were going in my car, I would like an
4 automobile mechanic. Now, their training may overlap a lot
5 and may use some of the same tools and concepts, but they have
6 different specializations. And it would be very important for
7 the safety of the passengers to have a mechanic with knowledge
8 about the type of machinery, the specific machinery, not just
9 a general assignment of an airplane mechanic to an automobile
10 or vice versa.

11 Q. In your field of epidemiology, how does an epidemiologist
12 determine whether or not there is effect modification?

13 A. Well, the first step is to have some idea of a causal
14 model --

15 Q. Okay.

16 A. -- typically. And actually I could back up and say there
17 are two kinds of approach to data analysis in which there
18 might be interaction or effect modification. And one
19 approach, we simply refer to this as having a predictive
20 model. In that approach, there's no implication about
21 causality. There's no interest in the mechanisms or
22 understanding why. It's only about having a statistical
23 prediction. That's called a predictive model.

24 Q. Okay.

25 A. And the more common approach, which is more useful for

Wing - Direct

1 public policy or for medical treatments and so on, is there's
2 interest in causality, what's really important and why.

3 In order to do that, variables in a dataset aren't all
4 the same. They're just not chosen out of a hat as though they
5 have equal status. One has to have some theory and mechanisms
6 that one understands about the process under investigation in
7 order to decide the status of these factors. And it's typical
8 that some kind of diagram would be drawn -- and they're often
9 called a causal diagram -- that would summarize the
10 relationships between the variables.

11 For example, an outcome might have -- an outcome might be
12 Y, and we might have potential -- several potential variables
13 related to the outcome Y; say, X1, X2, and X3. It could be
14 that X1 causes X2 which then causes Y. Or it could be that X1
15 causes Y, and X2 is a separate cause of Y that doesn't have to
16 do with X1. Or it could be that X3 is a factor which X1 has
17 an important effect at one level of X3 but not an important
18 effect at another level.

19 And those are the decisions -- such decisions recognizing
20 those relationships is not a statistical decision. It's based
21 on understanding the processes and mechanisms of disease or,
22 in the case of the court today, about stream ecology.

23 Q. Okay. Can you give an example, though, of how an
24 epidemiologist would determine whether an effect modification
25 is present?

Wing - Direct

1 A. Yes. Let me use an example from the field of cardio-
2 vascular epidemiology. An epidemiologist in cardiovascular
3 disease might be interested in whether obesity is a cause of
4 heart disease.

5 Now, the cardiovascular epidemiologist might be using
6 information from a study that collected information on a lot
7 of factors, such as cigarette-smoking, blood pressure, blood
8 cholesterol, diabetes, and other factors.

9 Now, it could be that the cardiovascular epidemiologist
10 would, because of understanding how these factors relate to
11 each other, would see that obesity would potentially cause a
12 heart attack because it affects blood pressure, blood
13 cholesterol, diabetes, and other factors. Those would, in
14 that case, be intervening factors.

15 The cardiovascular epidemiologist wouldn't control for
16 those factors because they're the mechanisms through which
17 obesity leads to heart disease.

18 So that's the kind of substantive knowledge that is
19 critically important in constructing a statistical analysis
20 that makes sense.

21 Q. Now let's move to confounding. You heard Dr. Garabrant
22 testify yesterday about confounding, didn't you?

23 A. I did.

24 Q. Do you agree or disagree with his analysis of what
25 confounding is?

Wing - Direct

1 A. I think -- I think I have -- his description of what
2 confounding is was not inaccurate, but it was incomplete.

3 Q. Is there, in fact, a settled definition of "confounding"
4 in the field of epidemiology?

5 A. Actually, confounding, like many concepts in science, is
6 a basic concept, but it's not a settled concept, meaning that
7 there are disagreements between epidemiologists, even in
8 textbooks, about exactly how to define "confounding."

9 Q. Dr. Garabrant's testimony from yesterday is based on the
10 premise that there's a settled definition of "confounding,"
11 isn't it?

12 A. Yes, it is. He used a very specific criterion, and he
13 believes that confounding exists if the difference between a
14 crude estimate and an adjusted estimate is greater than
15 10 percent.

16 Q. Okay. How did he come up with that? Do you know?

17 A. Well, first, I think it would be helpful for us to
18 revisit what is confounding.

19 Q. Okay. Let's do that.

20 Would you turn to Plaintiffs' Exhibit 170 in the book?

21 A. Yes, I have it here.

22 Q. And is that an article entitled "Toward a Clarification
23 of the Taxonomy of 'Bias' in Epidemiological Textbooks"?

24 A. Yes, it is.

25 Q. And is the author of that Sharon Schwartz et al.?

Wing - Direct

1 A. It's Schwartz et al. And I would note that it was
2 published in March of 2015. It's very current.

3 Q. Uh-huh.

4 A. And that it was published in a highly respected journal
5 in the field.

6 Q. What's the journal?

7 A. It's called *Epidemiology*.

8 Q. Okay. Would you turn to the second page of that exhibit,
9 which is PE 2189.

10 A. Yes.

11 Q. Do you see the paragraph beginning, "We identified"?

12 A. Yes.

13 Q. Would you read that paragraph into the record, please?

14 A. "We identified and reviewed 28 textbooks that met the
15 inclusion criteria (Table 1). Our review verified the norm of
16 categorizing bias into confounding, selection bias, and
17 information bias. All textbooks that included an organizing
18 scheme (24 of 28) used these categories. However, only one
19 textbook articulated the 2 elements of a consistent taxonomy -
20 a feature that unites confounding, selection bias, and
21 information bias and a feature that differentiates them.
22 There was variation across textbooks as to how close they came
23 to a clear description of the structure of their schema."

24 Q. So what does that mean?

25 A. That means that -- so the authors used the concept of

Wing - Direct

1 taxonomy which is general to scientific disciplines and to
2 other disciplines, I would imagine the law and history as
3 well, essentially creating a systematics in which there's a
4 root category defined by characteristics that are properties
5 of all its subcategories, and there are subcategories, each of
6 which is clearly distinguishable and separate from or
7 different from the other subcategories.

8 The authors of this article who reviewed this taxonomy in
9 the 28 epidemiology textbooks found that that -- those
10 definitions differed and were unclear. They didn't all meet,
11 most of them -- only one of them met this criteria -- both of
12 these criteria that the -- that biases defined in confounding
13 were all derived from a common set of properties, the root of
14 the taxonomy, and that they were clearly distinguished from
15 each other.

16 Q. So, again, that's just -- that's another way of saying
17 that there's not a settled definition of "confounding" within
18 the field.

19 A. For me, it makes clear that not only does -- is there
20 not -- there is not a set of rules for saying whether or not
21 there's confounding, quantitative statistical rules. There is
22 not a set of rules. And, furthermore, that different
23 textbooks and different epidemiologists have somewhat
24 different definitions of "confounding."

25 So even if there were rules, they would have different

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1 rules.

2 Q. And, again, that pushes you further into your earlier
3 testimony that in order to make an informed -- to do an
4 informed analysis of a piece of science, you have to
5 understand the science you're critiquing, right?

6 A. You have to understand the substance of the topic.
7 There's no generic analytic method which produces reliable
8 science.

9 Q. There's not a set of rules that you get up in the morning
10 and you follow one, two, three and four, and it generates its
11 own answer after following the rules, right?

12 A. That's correct.

13 Q. Is confounding a concept that was developed in the
14 context of controlled experimentation?

15 A. Yes. That's a very key idea. So nature is complex; and
16 to understand it, we have many different approaches. One of
17 those approaches, one tool for understanding nature is the
18 experiment. And by an experiment, I mean a method of making
19 observations in which one factor is varied and everything else
20 is held constant and we observe the result.

21 Classically, in my field, this takes place in clinical
22 trials where patients are randomized to either receive or not
23 receive a pharmacologic agent and they are chosen to be
24 similar so that there's not a lot of variation from other
25 factors. There's selection criteria or admission criteria,

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1 and they're treated in other ways the same. And the idea here
2 is that we can isolate the effect of this exposure from all
3 the other complexities of nature.

4 Now, what's key here is that nature doesn't work like an
5 experiment.

6 Q. Right.

7 A. So the experiment is a model. It's a very useful model
8 for investigation, but it's only a model. From that model,
9 which we use all the time -- and even if we're not conducting
10 an experiment, we typically, in an analysis of non-
11 experimental studies, sometimes called observational studies,
12 we use the same analytic methods. We're trying to imitate the
13 experiment.

14 And this is where the idea of confounding comes from.
15 Confounding would occur if the experimental group that
16 receives the treatment is in some other way different from the
17 control group that doesn't receive the intervention. And if
18 that difference, if the difference between, in this other
19 factor, could explain the outcome, it means that the outcome
20 is not necessarily due to our intervention, and we would need
21 to develop methods to identify that situation, which
22 epidemiologists call confounding.

23 Q. And the controlled experiment model that you just
24 described where you hold one factor constant in an area of
25 investigation like the benchmark is investigating isn't

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1 practical, is it?

2 A. It is clearly impractical. And one of the criticisms
3 that exists within epidemiology and I think is sometimes
4 misapplied to -- within the field, as well as to other fields,
5 is the idea that the only approach to science that is reliable
6 and valid is to conduct an experiment.

7 And what's -- what we have to recognize is that some of
8 the greatest scientific accomplishments of all times have been
9 totally without any kind of experiment.

10 Q. Like what?

11 A. So, for example, we used to believe that the continents
12 on the earth didn't move. Now we have, through geology, since
13 the 1950s or '60s, an understanding of plate tectonics, that
14 continents move around and that this is a critical part of the
15 history of our planet. There were no experiments done.

16 Similarly, with my understanding of evolution and
17 biology, that wasn't based on experiments. Our understanding
18 of most aspects of astronomy and astrophysics, those are not
19 experimental disciplines.

20 Even within my field, the conclusion that cigarette-
21 smoking is a cause of many diseases is not based on
22 experiments.

23 So what's clear is that this -- although it's an
24 important tool, it's not a *sine qua non* of scientific
25 investigation.

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1 Q. And has that model of experimentation been sometimes
2 inappropriately applied to critique and cast doubt on science
3 that's not based on that kind of experimentation?

4 A. Absolutely. And that's become more common in recent
5 decades in this country.

6 Q. What are some controversies that are now settled
7 questions scientifically that were subjected to great scrutiny
8 by the scientific, you know, the scientific method kind of
9 approach or the experimental method kind of approach?

10 A. I'll use -- I'll start with an example from my field --

11 Q. Okay.

12 A. -- which is the health effects of cigarette-smoking --

13 Q. Okay.

14 A. -- which have, for the most part, been identified in
15 their general form by the early 1960s, which is when the U. S.
16 Surgeon General produced this major report identifying
17 cigarette-smoking as a cause of lung cancer and other cancers
18 and cardiovascular diseases.

19 For decades, epidemiologists dealt with this idea of,
20 well, there could be some factor that differs between smokers
21 and non-smokers that causes these other diseases and we just
22 haven't found it, and no experiment was done. And, of course,
23 later we learned that --

24 Q. You can't really experiment because you can't experiment
25 on humans.

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1 A. Well, you can't experiment on humans with agents that are
2 believed to be toxic. So we routinely experiment on humans
3 with, for example, drugs or other therapies that might
4 actually help them and we don't know.

5 But things that we know to be harmful or we strongly
6 suspect to be harmful, we have ethical principles that
7 prohibit us from experimenting on people.

8 Q. So in the tobacco debates of 10, 20 years ago, many
9 epidemiologists were hired by the tobacco industry to make
10 just the kinds of arguments with confounding and lack of
11 experimentation that we heard Dr. Garabrant give yesterday.

12 Is that fair?

13 A. The tobacco industry is perhaps the best example of a
14 highly developed approach to manufacturing doubt.

15 Q. Would you say the same is true of climate change today?

16 A. It's another famous example, yes.

17 Q. Now, yesterday Dr. Garabrant testified about EPA's hiding
18 the data. Do you recall that?

19 A. I do.

20 Q. Is there an example you can think of that shows that
21 EPA's -- and I think the word used is "truncation" of data in
22 the benchmark is actually a standard method within the field
23 of epidemiology and other scientific fields?

24 A. I can give you an example from my own work. One of the
25 topics that I've been investigating for some time, over maybe

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1 about the last 10 or 15 years, has to do with the health
2 effects of air pollution from industrial animal production
3 facilities that release toxic gases and particles.

4 When we have conducted studies of the human health
5 impacts of exposure to these plumes of air pollution, we have,
6 for example, excluded smokers. And there's a reason for doing
7 that, for removing, either by design or analysis, data from
8 smokers, because smoking is a known cause of respiratory
9 disease. It affects human olfaction and other systems related
10 that are very important in terms of determining the health
11 effects of exposure to these air pollution plumes.

12 So if I removed data from smokers just to look at
13 non-smokers, I wouldn't describe that as hiding the data.

14 Q. And, in fact, somebody looking at it from the outside
15 who's not part of your discipline may not understand why you
16 excluded the smokers, right?

17 A. They might not, unless I explained it to them.

18 Q. So something that could be fairly common knowledge within
19 a discipline, within one discipline, may be okay to someone
20 looking from the outside who may not understand why things
21 were done unless he or she is part of that discipline, right?

22 A. Right. And this comes about commonly because in graduate
23 school, we teach how to communicate with other specialists,
24 but we don't either teach or encourage students to learn about
25 and practice more general communication.

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1 Q. So the benchmark, for example, is a specialist's
2 document, isn't it? It's not intended for a general audience.

3 Is that fair?

4 A. That's very fair.

5 Q. Has the need to make judgments about complex mixtures
6 factors been recognized in epidemiology?

7 A. It's a recognized problem, yes.

8 Q. Okay. And let's just use your smoking example. How does
9 that play out in the field of smoking --

10 A. Right.

11 Q. -- research?

12 A. Well, cigarette smoke is not a single chemical or a
13 physical agent. It's a complex mixture that contains many
14 toxic gases. It contains radioactive particles. It contains
15 physical particles of different sizes that penetrate the
16 respiratory tract at different depths from the nose and throat
17 down to the very small airways, depending on the sizes of the
18 particles. So it's a very complex mixture.

19 In the case of studies of smoking, we typically assess
20 human exposure by asking people how much they smoke. So it's
21 fairly convenient. But if we needed -- if we made an analogy
22 to, say, air pollution released by a factory, which could also
23 be similarly complex, we might pick a particular component of
24 that mixture to measure.

25 In my own work on animal factories, we have used hydrogen

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1 sulfide, a toxic gas, as a marker of a complex mixture because
2 it -- we have instruments that can measure that at the ambient
3 concentrations to which people are exposed.

4 Now, the mixture that produces the responses that we have
5 identified in our studies and that other people have
6 identified, it is not hydrogen sulfide as a pure gas. That's
7 just a part of a mixture. And a benchmark or a tool for
8 regulating exposure to the mixture might be a particular
9 component, something that's easy to measure.

10 And from my reading of this topic, which is new to me and
11 I read because of your asking me to review Dr. Garabrant's
12 document, we have a similar situation with conductivity.

13 Conductivity is something that's measurable. It can be
14 evaluated quickly in the field. It represents something about
15 the ionic concentration in water and surface waters. It's not
16 by itself the only thing that's going on, but it's useful as a
17 marker.

18 Q. Now, a few minutes ago, you said, I think, that
19 Dr. Garabrant's view is that the only way to adjust
20 confounding is to compare a crude estimate and an adjusted
21 estimate, but you wanted to wait until we talked a little bit
22 more about confounding to criticize or to critique that.

23 A. Yes.

24 Q. What did Dr. Garabrant mean by that, and do you agree or
25 disagree with it?

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1 A. So in his report and in his testimony, Dr. Garabrant
2 argued that the way to evaluate confounding is to first
3 estimate the relationship between an exposure or a variable
4 and the outcome in a crude form, meaning ignoring all other
5 factors that may be important --

6 Q. Right.

7 A. -- and then to reevaluate that relationship, adjusting
8 for some other factor. And if there's more than a 10-percent
9 difference in the estimate, Dr. Garabrant argues then
10 there's -- confounding is present and that EPA's benchmark is
11 invalid because they didn't use that method. Now --

12 Q. What do you think of that?

13 A. Now, the fact is that there are other approaches to
14 evaluating confounding, this idea.

15 Q. Right.

16 A. And I'll give you an example. Suppose we were interested
17 in whether the death rate depends on what state you live in.
18 So is the death rate higher in State 1 compared to State 2?

19 We might compute -- begin by computing the crude death
20 rate, which would simply be the number of deaths divided by
21 the number of people who live in the state in a particular
22 year. And we might see that State 1 has a higher death rate
23 than State 2.

24 However, we might think, well, suppose people in State 1
25 are not the same age as people in State 2; there's a different

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1 age distribution. And so, for example, if State 1 were
2 Florida and State 2 were Alaska, we would see Florida has a
3 higher death rate, but it has an older population.

4 So the first -- a first step we might take to evaluate
5 whether age is a confounder of the relationship between state
6 of residence and the death rate, we might begin by looking at
7 age-specific death rates. This is done all the time.

8 So we would look at the death rate for children and for
9 young adults and middle-aged and older adults separately. And
10 actually if we did that, we would see that the death rate in
11 Alaska is higher within each age group.

12 Now, that right there would tell us there's confounding
13 because the direction of the difference in the death rates has
14 reversed depending on whether we're just looking at everyone
15 all together or whether we subdivide the population by age.

16 We could also use the method that Dr. Garabrant argued
17 for, which would be adjusting for age, or we could restrict,
18 which is what EPA did in their benchmark. They looked at just
19 within a level. They said for a factor, well, let's examine
20 waters that have the same pH, for example.

21 Q. Okay. So different methods to the same question?

22 A. Yes. And so what I disagree with is not that
23 Dr. Garabrant's method is inappropriate, but it's not the only
24 method. There are several ways that epidemiologists approach
25 this, and they are very well-known and have been described in

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1 textbooks for many decades.

2 Q. Well, what about the 10 percent that you mentioned that
3 Dr. Garabrant used as a threshold? Where did he come up with
4 that, and do you see that as a valid number?

5 A. It's an arbitrary number. It's one that I've heard other
6 people use, but it's not used all the time. And I think
7 Dr. Garabrant actually said that yesterday and suggested some
8 other values.

9 And the fact is that there are other considerations; for
10 example, sample size. If one is dealing with small studies,
11 then there tends to be a lot of variability because the
12 presence or absence of one data point might make a big
13 difference if there's a small sample size, whereas if there's
14 a large sample size, removing or introducing one or two data
15 points makes very little difference because one has a lot of
16 data.

17 Q. Okay. Dr. Garabrant testified yesterday -- and I think
18 this is a quote. It's close if it's not. "You can't say what
19 the -- you can't say that the data -- you can't say what the
20 data might say when you don't have the data."

21 Do you recall him testifying to something at least close
22 to that?

23 A. I do. I do.

24 Q. And have epidemiologists -- we'll go back to the
25 cigarette example. Have epidemiologists now concluded that

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1 cigarette-smoking causes heart disease?

2 A. Yes. So with respect to Dr. Garabrant's testimony, he's
3 saying that he was able to make firm conclusions because he
4 had the EPA data --

5 Q. Right.

6 A. -- and other scientists didn't have the data and didn't
7 conduct the analyses that he conducted.

8 Q. Well, he's missing data too, right? Dr. Garabrant
9 testifies that there was hidden data.

10 Well, strike the question. Withdraw the question.

11 A. Okay. So just to continue --

12 Q. He's looked at data that -- data that others haven't
13 looked at.

14 A. Yes, and he's also -- but he's only looked at data that
15 others have looked at.

16 Q. Right.

17 A. Specifically, the EPA investigators who developed the
18 benchmark.

19 Q. His testimony is that they looked at it and then hid it,
20 right?

21 A. Well, that was part of his testimony. But he was arguing
22 that unless you have complete information, you can't come to a
23 conclusion.

24 Q. Right.

25 A. And what I would say is that we never ever have complete

Wing - Direct

1 information, yet we must come to conclusions, and we are
2 responsible to come to conclusions in order to ever do
3 anything. And the cigarette-smoking example is a great one.

4 We never have been able to show, for example, that people
5 who smoke versus people who don't smoke have -- that they
6 might have different diets, they might have different
7 genetics, yet we have concluded based on an overwhelming body
8 of evidence, even though we don't have the data that
9 cigarette-smoking causes a wide range of diseases.

10 So this gets back to the manufacturing doubt issue. We
11 can always identify something that we wish we had measured
12 that we couldn't measure. But it shouldn't paralyze us.

13 Q. And are there still epidemiologists that are doubtful
14 about whether cigarette-smoking causes heart disease?

15 A. Well, I haven't done a survey of epidemiologists, but I
16 would say if there are, they are very uncommon.

17 Q. Okay. Now, you weren't asked to analyze the validity of
18 the benchmark, were you?

19 A. No, I wasn't.

20 Q. And you're not qualified to do that as an epidemiologist,
21 are you?

22 A. I am certainly not qualified.

23 Q. What opinions do you think Dr. Garabrant offered
24 yesterday that are beyond the expertise of an epidemiologist
25 without a thorough knowledge of stream ecology?

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1 A. In my assessment, his statistical analysis and his
2 opinions about the benchmark are uninformed for the most part
3 by a nuanced and thorough understanding of the topic of stream
4 ecology, which would be necessary for a proper evaluation of
5 that topic.

6 Q. Okay. And you mentioned that epidemiology isn't just
7 data analysis. I think probably would you agree that ecology
8 is not just data analysis either?

9 A. I would agree with that.

10 Q. So what is the difference between epidemiology and data
11 analysis?

12 A. Epidemiology requires substantive knowledge about a
13 topic; and as we discussed earlier, the field of epidemiology
14 is very broad. And my preparation is suitable for my work in
15 environmental and occupational health, but I'm not a pharmaco-
16 epidemiologist. I'm not a genetic epidemiologist. I know
17 something about those areas, but I don't proffer myself as an
18 expert in those topics.

19 Q. Let's turn to the defendant's exhibit book and look at
20 the figures that Dr. Garabrant -- may I approach, Your Honor?

21 THE COURT: You may.

22 BY MR. LOVETT:

23 Q. -- the figures that Dr. Garabrant testified about
24 yesterday. I think he prepared these figures.

25 If you would turn to Exhibit 33, which is figure 6. I

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1 hope I'm right in the exhibit numbers. There was some
2 confusion, but I think we've got them straight now.

3 So look to make sure that Defendant's Exhibit 33 is
4 figure 6.

5 A. Yes, that's correct.

6 Q. Did you hear Dr. Garabrant testify about this figure
7 yesterday?

8 A. I did.

9 Q. Is it your understanding that he prepared it as part of
10 his expert report?

11 A. This is definitely part of his second report that I saw.

12 Q. Okay.

13 THE COURT: Excuse me. Can you -- I've got
14 Dr. Garabrant's report. I don't have all these --

15 MR. LOVETT: Figure 6.

16 THE COURT: Which of the charts is that, to make
17 sure I get the right one?

18 MR. LOVETT: The percent of sites --

19 THE WITNESS: It looks like this. (Indicating)

20 MR. LOVETT: "Percent of sites with Ephemeroptera by
21 conductivity and dissolved oxygen."

22 THE COURT: All right. Thank you.

23 MR. LOVETT: And then I think we'll go through 6, 7,
24 8, 9, and we'll be finished.

25 BY MR. LOVETT:

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1 Q. So what does this figure depict?

2 A. So what we see here on the vertical axis is the percent
3 of sites with Ephemeroptera present; and on the horizontal
4 axis, we have conductivity. And --

5 Q. Did Dr. Garabrant -- I'm sorry. Go ahead.

6 A. And the graph gives us information about the relationship
7 between conductivity and the presence of Ephemeroptera
8 according to the levels of dissolved oxygen.

9 And so there are three lines in this figure, and the
10 figure is depicting the relationships for the three levels of
11 dissolved oxygen, and it's the relationship between
12 conductivity and Ephemeroptera.

13 Q. Is there information that's missing here just in labeling
14 that should be on any epidemiological graph of this sort?

15 A. Well, first, let's -- let me comment that Dr. Garabrant
16 created this figure and used it in his critique of the EPA
17 benchmark and argued that the figure shows evidence of effect
18 modification --

19 Q. Right.

20 A. -- and that if effect modification is present, then their
21 benchmark is invalid. And he argued that this figure shows
22 there's effect modification.

23 Now, let me respond to your question, is there anything
24 missing here.

25 Q. Yes.

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1 A. Now, as an epidemiologist, I look at graphs like this all
2 the time.

3 Q. For a journal --

4 A. And if I were a reviewer for a journal, I would be
5 looking at a graph like this, except instead of Ephemeroptera
6 on the vertical axis, it might be the cancer rate; and instead
7 of conductivity on the horizontal axis, it might be exposure
8 to a toxin. That would be something that I would commonly
9 see.

10 Now, what's missing from this graph, well,
11 epidemiologists typically indicate something about the
12 precision or the sample size for the estimates. So the graph
13 here, the percent of sites with Ephemeroptera at the different
14 levels of dissolved oxygen are represented by a blue circle or
15 a red cross or a green X.

16 So if we look vertically at any point in the graph, there
17 are three symbols, and they represent the percent of
18 Ephemeroptera at different levels of dissolved oxygen for a
19 single level of conductivity. But there's no sample size.
20 There's no error bars or other estimates of precision.

21 So that's very important to interpreting this graph, and
22 it's missing. That information is missing.

23 And then to evaluate whether or not there is effect
24 modification or, in the language of other disciplines,
25 interaction, one might -- what we typically do is we estimate

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1 the average trend across all the levels of conductivity for
2 each level of oxygen, and we would come up with what we call a
3 slope. And this is the method that is called linear
4 regression, and it's used in most fields of science.

5 So we would compare the slopes to see if they're the same
6 or different. And they would always be different by some
7 amount because we never have exactly the same slope. So if
8 one were really ignorant about the methods of presenting data
9 with estimates of precision, one might say, oh, well, they're
10 different and say 1.2 is different than 1.3 or 1.1.

11 But if the precision is not very high, what an
12 epidemiologist and I think other analysts would typically
13 conclude is there's not enough information to conclude that
14 they're really different.

15 What I see when I look at this graph is that the trend is
16 similar in all three groups, that the percent of sites with
17 Ephemeroptera declines at each level of dissolved oxygen. And
18 if I were looking at a topic which I work on, for example, if
19 I were looking at the percent of people with difficulty
20 breathing according to their exposure to air pollution and I
21 saw a graph like that, I would say it looks to me like there's
22 no effect modification. The trend is similar. It's not
23 exactly the same. It's never exactly the same in groups when
24 we subdivide the data.

25 Q. So you don't believe that if this -- this graph depicted

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1 something that -- an area of your specialty, if you were
2 looking at a graph like this where you understood the data,
3 you would not say that this was effect modification being
4 shown in the graph?

5 A. I doubt -- well, I would say, just based on the graph, I
6 don't have enough information because there's no information
7 about sample size or precision. There are no slope estimates.
8 There are no standard error estimates for the slopes. So
9 that's all missing.

10 But just seeing this, I certainly wouldn't conclude that
11 there's effect modification and -- because at the very least,
12 the general trend is similar in the three groups.

13 Q. Okay. Let's turn to the next figure, figure 7, "Percent
14 of sites with Ephemeroptera by conductivity and total iron,
15 limited to streams with" --

16 A. Yes.

17 Q. -- "pH greater than 6."

18 A. So --

19 Q. Dr. Garabrant again uses this as an example of effect
20 modification?

21 A. He did.

22 Q. And what do you think about that?

23 A. Well, just to review, the figure has the same vertical
24 and horizontal axes. So, again, we're talking about percent
25 of sites with Ephemeroptera and conductivity, this time at

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1 levels of total iron. And, again, we have no information
2 about precision or sample size or we have no slope estimates.
3 But, again, it's clear that the trend is a downward trend for
4 all three groups. And so at least qualitatively, I would say
5 it doesn't look like there's interaction or effect
6 modification.

7 Q. How is it that you can look at one chart and
8 Dr. Garabrant look at the same chart and you come to
9 completely different conclusions about it?

10 A. It goes --

11 Q. You're both specialists in your area.

12 A. Yes. Well, it goes back to the principle that the data
13 don't speak for themselves, that they require some a priori
14 knowledge, some assumptions, some context. And so applying my
15 context, I would not conclude based on this figure that
16 there's effect modification.

17 I would also, if I may raise one other issue about what's
18 a concern I have about this assessment of effect modification,
19 we teach in our introductory epidemiologic classes -- and this
20 is part of the exams for the first- and second-year
21 students -- we teach that you can't evaluate effect
22 modification without choosing some scale on which to measure
23 it.

24 And so here's an example. Suppose I'm interested in the
25 occurrence of cancer in relation to exposure to some toxin,

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1 and the -- among people, for example, in one age group, the
2 people exposed to the toxin have a cancer rate of 20 per
3 thousand and the unexposed people have a rate of 10 per
4 thousand. That's a difference of 10 per thousand.

5 And suppose at another age group, the exposed -- people
6 exposed to the toxin have a disease, a cancer rate of 110 per
7 thousand and the unexposed people have a rate of 100 per
8 thousand.

9 Well, if our scale of assessing effect modification is
10 the absolute difference, there's no effect modification
11 because the difference between 10 and 20 and between 100 and
12 110 is 10 in both cases. It's the same effect. But if our
13 scale for measuring is a ratio scale or a percent difference,
14 in the first age group, the rate is doubled. Twenty is twice
15 as much as ten; whereas in the second age group, 110 is only
16 10 percent, not 100 percent more. And we would say there's
17 interaction or effect modification.

18 What I don't see from Dr. Garabrant is any specification
19 of whether his supposed effect modification is on an absolute
20 scale or on a relative scale. And at least in our department
21 and from what I can tell with students coming from other
22 graduate schools, it's common, even in introductory courses,
23 that the students learn that we have to choose -- we make a
24 choice, because our assessment of whether or not there's
25 effect modification depends on the scale we choose.

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1 Q. So you can't tell looking at this document what scale was
2 used.

3 A. Well, Dr. Garabrant hasn't told us.

4 MR. HARVEY: Your Honor -- Your Honor, I hate to
5 object. I've let this go on for a while, but none of this was
6 discussed at Dr. Wing's deposition, this issue about the scale
7 of the graph. He had every opportunity to talk about the
8 graphs and he didn't.

9 MR. LOVETT: He wasn't asked about --

10 MR. HARVEY: He most certainly was, Your Honor.

11 THE COURT: Well, he's called as a rebuttal expert
12 to the defense expert. So I think he's allowed to testify in
13 rebuttal.

14 THE WITNESS: And just for the record, I would note
15 that I did comment on these graphs in response to the
16 defendant's attorney at deposition.

17 THE COURT: Well --

18 BY MR. LOVETT:

19 Q. So I think I asked you the question about missing scale
20 and if that made it difficult to interpret the graph.

21 A. Well, I would -- it would be important to any assessment
22 of effect modification to specify whether it's -- what the
23 scale of the modification is.

24 Q. Okay. But still you're able to look at it -- I just want
25 to get to this one issue that I really don't understand. You

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1 look at it, even though there's information missing that makes
2 it difficult to interpret, and you say, just looking at the
3 slopes, no effect modification.

4 A. And so let me explain how I'm doing that.

5 Q. Yeah.

6 A. Okay. So I don't have the dataset, and I'm not -- I
7 don't have the software to conduct what's called a linear
8 regression analysis to calculate the slopes. But what we do
9 all the time when we look at data is we eyeball the data.
10 That's what we -- the typical term.

11 So I would look at these points, say the blue line with
12 the circles in this figure 6, and I would say, well, what
13 happened -- what would happen if I drew a straight line that
14 minimized the distance between the line and these points so
15 that it goes through the points rather than around them, and I
16 did the same for the red line and the green line.

17 Well, the slopes are different. The slopes would be
18 different, that's true. But they're all negative. The trend
19 is the same. And so from a substantive standpoint, the effect
20 of conductivity is to result in a decrease in the percent of
21 sites with Ephemeroptera in all three groups.

22 Q. And did Dr. Garabrant describe and explain, as you just
23 have, why he thought that this was an example of effect
24 modification?

25 A. I didn't hear him. So I don't understand -- I don't

Wing - Direct

1 believe he's given us adequate information to support his
2 conclusion that there's effect modification.

3 Q. And, lastly, let's just turn quickly to figure 9, which
4 should be the next one, and I'm going to ask you the same
5 questions about figure 9.

6 A. Okay. The next one actually is figure 8.

7 Q. Let me ask you about figures 8 and 9.

8 A. Okay.

9 Q. I'll ask you just -- you can answer for both now the same
10 question.

11 Dr. Garabrant in both cases testified that they were
12 examples of effect modification, and do you agree with him
13 about that?

14 A. Figure 8, he testified again that this was effect
15 modification. My assessment is the same as for the prior
16 figures. We lack critical information, but the slopes look
17 like they're in the same direction. They show a decline in
18 the percent of sites with Ephemeroptera for increases in
19 conductivity for figure 8 at three levels of total aluminum
20 and for figure 9 at three levels of total manganese. So I
21 disagree with Dr. Garabrant's interpretation.

22 Q. As an epidemiologist, you aren't qualified to give the
23 testimony that Dr. Garabrant provided yesterday to this Court,
24 are you, about the benchmark?

25 A. I'm not qualified in ecology or -- and I don't know the

Wing - Direct

1 field.

2 Q. Is it your opinion, having heard Dr. Garabrant's
3 testimony and knowing your field of epidemiology, that he was
4 not qualified to offer the testimony that he offered here
5 yesterday?

6 A. Well, I heard Dr. Garabrant describe his entry into the
7 field of stream ecology, and what I heard him say was that he
8 had not studied it prior to this case but he read a textbook
9 and that he consulted with an ecologist who does know the
10 field.

11 And I guess, based on my academic experience, I do not --
12 I would not present myself as an expert in other departments
13 based on reading an introductory textbook and talking with a
14 scientist who's in that department. I would not consider
15 myself competent to advise doctoral students or to write
16 articles for peer-reviewed journals or to chair committees in
17 that other field based on reading an introductory textbook and
18 consulting with one person who has expertise in the field.

19 Q. Did Dr. Garabrant testify yesterday that he asked any
20 ecologist to review his expert report?

21 A. I don't recall that.

22 Q. Okay. If you were writing something like this, would you
23 at least ask an epidemi -- I mean, excuse me, an ecologist to
24 review it?

25 A. Actually, I wouldn't write something like this in the

Wing - Direct

1 first place without engaging collaboration with people who
2 have expertise in the field.

3 Q. One last question -- or two questions. I'll ask one
4 penultimate question. Just because data has no effect, has an
5 effect modification or is confounding, that doesn't mean it's
6 useless data, does it?

7 A. No, it doesn't mean it's useless. In fact, effect
8 modification, which means that there's some variability in the
9 impact of the exposure between different population groups,
10 it's a universal phenomenon. There's always effect
11 modification.

12 This -- it's a basic principle, and it goes back to the
13 difference between statistics and the individual causation,
14 that statistics -- this kind of statistical analysis is
15 entirely about averages. But each person, each stream, each
16 species, potentially the same species in different
17 environments, they're different from each other.

18 So there's always effect modification, yet we typically
19 decide that we can make some useful conclusion about how some
20 factor affects those populations because it's similar enough
21 between groups.

22 So we don't say just because the heart disease rate
23 difference between smokers and non-smokers is different for
24 men and women, we don't say, well, so we can't conclude that
25 cigarette-smoking is dangerous for both. That's not -- it's a

Wing - Direct

1 universal phenomenon.

2 And the same thing, there's an analogous history with
3 confounding. There's always factors that we haven't measured
4 that might affect the relation between an exposure and an
5 outcome, but at some point we use our judgment about the topic
6 and our knowledge of the field and multiple studies, not just
7 one dataset, but we draw conclusions based on a history of
8 research in a topic in order to take actions that are
9 important for public policy.

10 Q. And do you hold all of the opinions that you've expressed
11 here today to a reasonable degree of scientific certainty?

12 A. I do.

13 MR. LOVETT: Thank you.

14 THE COURT: All right. Let's take a ten-minute
15 recess before cross-examination.

16 You can step down. Don't discuss your testimony.

17 (Recess from 10:37 a.m. to 10:58 a.m.)

18 THE COURT: All right. Are we ready to resume?

19 MR. LOVETT: Yes, Your Honor. Before Mr. Harvey
20 begins, I'd like to move the admission of Plaintiffs'
21 Exhibit 167 and 170, which were the two articles, to the
22 extent of what was read into the record by Dr. Wing.

23 THE COURT: All right. Any objection?

24 MR. HARVEY: No objection.

25 THE COURT: All right. Those portions, then, of

Wing - Cross

1 each of the exhibits are admitted.

2 And what exactly are you tendering as the exhibit? The
3 whole article?

4 MR. LOVETT: Well, I would tender the whole article,
5 but I think that all that's admitted --

6 THE COURT: Right.

7 MR. LOVETT: All that can actually be admitted into
8 evidence are the passages read by the witness.

9 THE COURT: That's fine.

10 MR. LOVETT: And one other thing I didn't realize,
11 figure 8, which is Exhibit 35, Defendant's Exhibit 35, is one
12 of the graphs that Dr. Wing testified to, defendants omitted
13 that yesterday. So I'd like to move the admission of
14 Defendant's Exhibit 35.

15 THE COURT: Any objection?

16 MR. HARVEY: No objection to its admittance, Your
17 Honor. I think Dr. Wing testified what he heard Dr. Garabrant
18 say about it.

19 THE COURT: Well, it's admitted.

20 MR. HARVEY: As far as I'm concerned, it can be
21 admitted.

22 THE COURT: All right. Ready for cross-examination?

23 MR. HARVEY: Yes, Your Honor.

24 THE COURT: Go ahead.

25 CROSS EXAMINATION

Wing - Cross

1 BY MR. HARVEY:

2 Q. Good morning, Dr. Wing.

3 A. Good morning.

4 Q. Let me start by thanking you for adjusting your schedule
5 as Dr. Garabrant did to be here yesterday and today. I
6 appreciate that.

7 A. You're welcome.

8 Q. Dr. Wing, you have been an associate professor at the
9 University of North Carolina since 1995, correct?

10 A. Correct.

11 Q. And do you recall your deposition of April 7, 2015?

12 A. That was when we met? Is that the date?

13 Q. That is correct.

14 A. Yes, I do.

15 Q. And at your deposition, I asked you if you were qualified
16 to be a full professor at the University of North Carolina.

17 Do you recall that conversation?

18 A. I recall our discussion of the professorial ranks, yes.

19 Q. And at the time, I believe you told me that you believe
20 you would, quote, meet the criterion in the view of some but
21 perhaps not in the view of others.

22 Do you recall that?

23 A. I don't recall saying those particular words, but that
24 sounds -- but I recall the discussion, yes.

25 Q. Okay. Is that an accurate reflection of our discussion?

Wing - Cross

1 A. I think so.

2 Q. Okay. And you told me at your deposition that in the 20
3 years you've been an associate professor, you've simply never
4 initiated the paperwork to become a full professor; is that
5 correct?

6 A. That's correct.

7 Q. Okay. As I think you and Mr. Lovett discussed, Dr. Wing,
8 epidemiologists often have backgrounds in human medicine,
9 correct?

10 A. Many do.

11 Q. Yes. And I think you told me at the University of North
12 Carolina, for instance, there are a large number of students
13 in the Department of Epidemiology who are medical doctors,
14 correct?

15 A. That we commonly have medical doctors or medical students
16 in our program, yes.

17 Q. Okay. But you also have people in the program who have
18 other backgrounds such as engineering I believe you told me,
19 correct?

20 A. That's one, yes.

21 Q. Or demography such as yourself, correct?

22 A. That's correct.

23 Q. Okay. Dr. Wing, I would like to discuss with you an
24 article that we discussed at your deposition. It's entitled
25 "The People's Professor."

Wing - Cross

1 Do you recall our discussion of that article?

2 A. Oh, yes, I do.

3 Q. Okay. Mr. Tyree is going to put that up on the screen.

4 And that was Exhibit 4 to your deposition. Do you recall
5 us talking about this exhibit?

6 A. I do.

7 Q. Okay.

8 THE COURT: You can see it down by the monitor to
9 your left.

10 THE WITNESS: Thank you.

11 THE COURT: Unfortunately, that monitor doesn't
12 move.

13 MR. HARVEY: Dr. Wing, let me do this. I have a
14 copy of your deposition.

15 May I approach, Your Honor?

16 THE COURT: Yes.

17 BY MR. HARVEY:

18 Q. This will be easier.

19 A. Thank you.

20 Q. You're welcome. And this appeared in the *North Carolina*
21 *Health News*. Is that correct, Dr. Wing?

22 A. Correct.

23 Q. Okay. And it's an article about you, correct?

24 A. Yes.

25 Q. From January of this year?

Wing - Cross

1 A. I don't see the date, but I accept that, yes.

2 Q. Okay. I'd like to discuss certain passages from this
3 article, if you will.

4 The first one Mr. Tyree will highlight on the bottom of
5 the -- or on the screen is near the bottom of, I think, the
6 page I gave you.

7 Do you see the one that starts with "Wing's career," that
8 paragraph, Dr. Wing?

9 A. Yes, I see that.

10 Q. And it says, "Wing's career at UNC has been marked by
11 similarly contrarian work, a body of research that reevaluates
12 official orthodoxy and that focuses on a kind of social
13 activism that's rare in academia. Though nested in a premier
14 research university, Wing believes his work to be in the
15 public's interest. He researches underrepresented and often
16 ignored populations and at times his work blurs the
17 conventional lines between detached university researchers and
18 community advocates."

19 Do you recall us discussing that paragraph?

20 A. I do.

21 Q. And I asked you about the highlighted portion; that is, I
22 asked you whether you were -- blurs the conventional lines
23 between detached university researchers and community
24 advocates.

25 Do you recall our discussion of that?

Wing - Cross

1 A. I recall that you raised it. I don't recall the details
2 of our discussion.

3 Q. Okay. I think you told me during your deposition that
4 university researchers are typically attached to the interests
5 of people who fund research.

6 Do you recall saying that?

7 A. I don't recall the specific words, but that's something
8 that I believe.

9 Q. Okay. And I asked you if that was true of yourself, and
10 you said yes, correct?

11 A. Correct.

12 Q. Okay. Later, the article poses a question which we also
13 discussed.

14 Mr. Tyree, can you scroll down? Continue scrolling,
15 Mr. Tyree. Keep going, Mr. Tyree.

16 Okay. Do you see, Dr. Wing, the paragraph that starts
17 with "Yet Wing's style raises a question"?

18 A. Which page are we on?

19 Q. Let me see if I can help you with that.

20 May I approach, Your Honor?

21 THE COURT: Yes, you may.

22 BY MR. HARVEY:

23 Q. Are you with me now, Dr. Wing?

24 A. I am.

25 Q. Okay. The article raises this question: "Yet Wing's

Wing - Cross

1 style raises a question. Is it a breach of objectivity if a
2 researcher explicitly advocates the mission of a community
3 organization, as does Wing?"

4 And then it quotes you as saying, "Wing said that pure
5 objectivity is a misguided aim. 'Scientists are driven by
6 ideologies and interests, whether they're partnering with a
7 pharmaceutical company or a nonprofit organization,' he said.
8 'The important part,' he added, 'is to be clear about your
9 affiliations and to follow proper scientific research
10 methods.'"

11 Is that an accurate quote of your view?

12 A. I probably said something more like "pure objectivity is
13 a misguided concept" rather than "aim." But basically it's
14 correct.

15 Q. And you agree that in your view -- your view is that
16 scientists are driven by ideologies and interests.

17 A. I wouldn't say it that way. First, I would say that
18 objectivity is not a state of detachment from the world,
19 meaning having no point of view.

20 Objectivity is a process of understanding the basis of
21 forming knowledge so that influences that are necessary to
22 create science are understood and recognized and evaluated,
23 rather than the idea that objectivity -- I think it's
24 misguided that the concept of objectivity as being able to
25 remove oneself from the history of knowledge and language and

Wing - Cross

1 other background; rather, it's to explicate that background.

2 And I would not say that scientists are driven by
3 ideologies, but rather we -- all of us, whether scientists or
4 not, have some point of view which might be an ideology. It
5 might be described in other ways. But I don't think we can
6 even approach science without having a point of view.

7 Q. Okay. These are complicated concepts. Let's see what
8 you said at your deposition.

9 Mr. Tyree, could you return to Dr. Wing's deposition?
10 Page 74.

11 There's a question. Do you see that, Dr. Wing, that
12 starts, "Okay. Did you say that" -- do you see that question
13 in the deposition?

14 A. I do.

15 Q. Okay. So I'll play the part, just to make it easy, of
16 me, and you play you, okay?

17 The question: I said, "Okay. Did you say that
18 scientists are driven by ideologies and interests, whether
19 they're partnering with a pharmaceutical company or a
20 nonprofit organization?"

21 And you answered?

22 A. "That's a -- that could be a paraphrase of something that
23 I said."

24 Q. Okay. Okay. And you have personally called for a
25 moratorium on mountaintop removal mining, correct?

Wing - Cross

1 A. I was part of a group that issued a report on that. I
2 wouldn't say it was personal, but it was part of a group.

3 Q. Okay. Let's discuss that.

4 I'd like to show you a document that we discussed also at
5 your deposition. It's entitled "The Health Impacts of
6 Mountaintop Removal Mining," and it's described as a report to
7 the National Commission on the health impacts of mountaintop
8 removal mining.

9 Do you recall that document?

10 A. I do.

11 Q. It was Exhibit 2 to your deposition, if you'd like to
12 find it in the deposition transcript I gave you.

13 May I approach, Your Honor?

14 THE COURT: Yes, you may.

15 THE WITNESS: Exhibit 2. Right here? Thank you.

16 BY MR. HARVEY:

17 Q. According to the page behind the cover page, Dr. Wing --
18 you skipped down too many pages, Mr. Tyree.

19 Keep going up, Mr. Tyree. Keep going.

20 Mr. Tyree, if you could go to the page right behind the
21 cover page that we were just looking at. On up.

22 Okay. This was something prepared in April of 2013 by
23 the Center for Health, Environment & Justice, correct?

24 A. Correct.

25 Q. Who are they?

Wing - Cross

1 A. The Center for Health, Environment & Justice is, my
2 understanding, is a nonprofit organization that was started by
3 Lois Gibbs, I think several decades ago, and they -- they're
4 headquartered in the Washington, D. C. area.

5 Q. Okay. And this is a report from the Center for Health,
6 Environment & Justice to the National Commission on the health
7 impacts of mountaintop removal mining, correct?

8 A. Yes.

9 Q. Okay. And if we could turn to page 2 of the document,
10 there's a list of Commission members, members of this National
11 Commission that the report was sent to.

12 Do you see that?

13 A. Yes. You're referring to -- oh, I see. Hold on. I'm
14 not on the right page.

15 Q. Cynthia Bearer is the first Commission member. Do you
16 see that?

17 A. Yes. I don't -- I'm not on the right page of the report.
18 Which page is it?

19 Q. It's complicated because it's paginated very oddly.
20 That's why Mr. Tyree and you and I are having trouble.

21 May I approach, Judge?

22 THE COURT: Go ahead.

23 THE WITNESS: Oh, great. Okay. Thank you.

24 BY MR. HARVEY:

25 Q. So beginning on page 2, there's a list of Commission

Wing - Cross

1 members, correct?

2 A. Correct.

3 Q. And if we turn to page 3, you're listed as one of the
4 Commission members, correct?

5 A. Correct.

6 Q. Okay. And so you were on the National Commission?

7 A. Yes.

8 Q. Okay. And the National Commission made certain
9 recommendations. Do you recall that?

10 A. I do.

11 Q. Okay. And those are on page 1 of the document; is that
12 correct?

13 A. I believe they're on pages 1 and 2.

14 Q. Okay. And the first of the Commission's recommendations,
15 of which you were a part, is that there be an immediate
16 moratorium on mountaintop removal mining; is that correct?

17 A. Yes. It begins, "Preventative action in the face of
18 uncertainty is warranted."

19 Q. You can continue to read.

20 A. "The findings in this report make clear that there is
21 sufficient documentation of the hazards of MTR, mountaintop
22 removal, mining to place an immediate moratorium on MTR mining
23 until such time as health studies have been conducted that
24 provide a clearer understanding of the associations between
25 adverse health impacts, notably adverse reproductive outcomes,

Wing - Cross

1 and MTR mining."

2 Q. Okay. Thank you.

3 And as we discussed at your deposition, there were news
4 reports about this Commission finding and Commission report.

5 Do you recall that?

6 A. Yes.

7 Q. Okay. Let's turn to one of those.

8 And, Dr. Wing, this is Exhibit 3 to your deposition, if
9 it helps you.

10 This was published by the Institute for Southern Studies.
11 You're familiar with them, correct?

12 A. Yes, I am.

13 Q. Okay. And it quotes you as saying the following:

14 "'The evidence shows that mountaintop removal threatens
15 public health and the environment,' said Dr. Steven Wing, an
16 associate professor of epidemiology at the University of North
17 Carolina and a member of the Commission. 'It's time to act to
18 protect rural communities.'"

19 A. That's correct.

20 Q. And I believe you told me at your deposition that's an
21 accurate quote by you.

22 A. As far as I remember.

23 Q. Okay. And you told me at your deposition that this is an
24 issue of social justice to you.

25 Do you recall that?

Wing - Cross

1 A. I don't recall specifically, but that's reasonable, I
2 believe.

3 Q. Okay. And in reaching this conclusion and calling for
4 this moratorium, I believe you told me at your deposition that
5 you didn't collect or analyze any data, correct?

6 A. I didn't conduct statistical analyses of data, that's
7 correct.

8 Q. Okay. You didn't conduct an epidemiological analysis at
9 all, correct?

10 A. This was based on a review of literature of studies
11 produced by others.

12 Q. Studies sent to you by the Center for Health and
13 Environmental Justice?

14 A. They sent me articles, and I also saw other articles they
15 did not send me.

16 Q. Oh, okay. I think that's different than what you
17 testified at your deposition, but I'll accept that.

18 A. Okay.

19 Q. So you had some articles and you called for a moratorium,
20 correct?

21 A. Not personally, but as part of this group of scientists
22 who reviewed the literature.

23 Q. Did you work with the other scientists?

24 A. I never met them personally, and there were no meetings
25 of this Commission. I worked directly with the Center for

Wing - Cross

1 Health and Environmental Justice staff.

2 Q. Okay. So there was no collaboration with the other
3 experts on the National Commission.

4 A. There were draft copies that we reviewed. So to the
5 extent that there was collaboration, it was through electronic
6 communication.

7 Q. Okay. But you've never met these other Commission
8 members. That's what you told me at your deposition, that you
9 did not.

10 A. We didn't meet as a commission. Now, if I've ever met
11 any of the members, I'm not so sure about that.

12 Q. You can look at your deposition if you want, but you told
13 me you had never met them.

14 A. Dr. Wartenberg I do know at least by --

15 Q. Reputation?

16 A. -- reputation. And I'm not remembering whether I've met
17 him at professional societies or not.

18 Q. Okay. Let's switch gears and talk about epidemiology.
19 There are recognized techniques for identifying effect
20 modifiers; is that correct?

21 A. There are a number of methods, yes.

22 Q. And most epidemiology textbooks have discussions of
23 effect modifiers and describe those techniques, correct?

24 A. Correct.

25 Q. Okay. And I believe you told me at your deposition

Wing - Cross

1 effect modification is something that can happen not just with
2 humans and human data, but also with data regarding plants and
3 animals and bugs, correct?

4 A. Correct.

5 Q. So effect modification is something that can impact the
6 dataset that EPA worked with.

7 A. I believe I said effect modification is universal, so
8 it's present everywhere.

9 Q. Thank you.

10 And the same is true of confounding, correct?

11 A. Confounding, as I said earlier, is a consequence of a
12 model in which we posit that a particular factor has an
13 independent effect on an outcome, holding everything else
14 constant.

15 So within that model of investigation, confounding may or
16 may not occur, but it's always something that we would want to
17 evaluate.

18 Q. But it is present in not just data relating to human
19 systems, but also data relating to other ecological systems.

20 A. Well, confounding isn't a property of data. Confounding
21 is a property of a model of understanding nature in which we
22 begin with or we posit the assumption that a factor has a
23 unique effect on some outcome, holding everything else
24 constant.

25 And that doesn't happen in nature, but it's a useful

Wing - Cross

1 model. It's the model of the experiment for investigating
2 mechanisms.

3 Q. But it does occur with other systems other than human
4 systems, correct?

5 A. Yeah, it occurs -- under this model, it could occur in
6 any aspect of nature that we might investigate.

7 Q. Okay. And there are recognized techniques for addressing
8 confounding, correct?

9 A. Yes.

10 Q. Okay. And do you agree that it's important to identify
11 and control for confounding when conducting studies?

12 A. Yes.

13 Q. Okay. And I think Mr. Lovett and you talked about this,
14 but you don't have any opinions on whether EPA properly
15 conducted epidemiology when they created the benchmark,
16 correct?

17 A. I don't have opinions about the ecology, the discipline
18 of ecology which is at issue here.

19 Q. And you don't have any opinions as to whether they
20 properly evaluated confounding.

21 A. That's correct.

22 Q. Okay. So if EPA got the epidemiology wrong, you don't
23 know; you haven't looked at it.

24 A. Well, I guess I wouldn't call what EPA was doing
25 epidemiology because epidemiology is the study of health and

Wing - Cross

1 disease in human populations, and that's not what EPA was
2 doing.

3 Q. Are you aware that's what EPA claimed it was doing?

4 A. My understanding is they presented some of their methods
5 as being derived from epidemiology.

6 Q. Have you attempted to replicate any of EPA's findings?

7 A. No.

8 Q. Did you seek to collaborate with any ecologists to
9 analyze the benchmark?

10 A. No.

11 Q. You could have done that, though, correct?

12 A. I could have, yes.

13 Q. Could EPA have collaborated with epidemiologists?

14 A. Yes.

15 Q. But they did not, did they?

16 A. I don't know the history of their work and what led up to
17 their final publication, so I can't comment on that.

18 Q. Okay. And you haven't looked at the underlying EPA data,
19 have you?

20 A. I have not.

21 Q. And you've done no calculations with respect to
22 Dr. Garabrant's conclusions, correct?

23 A. Correct.

24 Q. You've not tried to disprove or replicate his work in any
25 way?

Wing - Cross

1 A. That's correct.

2 Q. Okay.

3 A. I would say specifically I have not tried to replicate
4 any of his calculations. I haven't worked with his -- with
5 the dataset that he used.

6 Q. Okay. But you had that opportunity.

7 A. I didn't ask for the opportunity to analyze the data.

8 Q. Okay.

9 Mr. Tyree, can you go to page 116 of the deposition
10 transcript?

11 Do you recall -- I'll give you a moment, Dr. Wing. Tell
12 me when you've found it.

13 A. Yes.

14 Q. And earlier, you and Mr. Lovett discussed certain figures
15 prepared by Dr. Garabrant. Do you recall that?

16 A. I do.

17 Q. And you criticized those and said they lacked scale, and
18 had other comments. Do you recall that?

19 A. I recall our discussing these figures that are the same
20 ones on page 116 here --

21 Q. Yes.

22 A. -- that we just discussed earlier and Dr. Garabrant
23 discussed yesterday.

24 Q. Let's do what you and I did earlier, and I'll play me and
25 you play you.

Wing - Cross

1 A. Okay.

2 Q. And we'll talk about the discussion you and I had about
3 these figures at your deposition, okay?

4 Question: "Okay. Did you form any other opinions after
5 reading Dr. Garabrant's report?"

6 A. "I did look at a number of the graphs in his report,
7 beginning on page 7. So there's figure 2, 3, figure 5, 6, 7,
8 8, 9, are all figures that evaluate the relationship between
9 conductivity and Ephemeroptera. And what I noticed is that
10 all of Dr. Garabrant's figures suggest that there's a decline
11 in Ephemeroptera with increased conductivity in every one of
12 those figures."

13 Q. Okay. And I say, "Okay. Why is that important?"

14 And you respond?

15 A. "It's my understanding that Dr. Garabrant is presenting
16 this as evidence that conductivity is not important as a
17 measure of water quality that's associated with Ephemeroptera,
18 and I believe that the figures he produces here generally
19 support the position that it is important."

20 Q. And then I ask, "Do you think the figures also show that
21 the importance varies depending on what other factors are
22 present?"

23 And you said?

24 A. "That's one possible interpretation. Yes."

25 Q. And I said, "Okay. Is that not important?"

Wing - Cross

1 A. "It could be."

2 Q. Okay. Then I said, "Have you developed any other
3 opinions about the report of Dr. Garabrant, the second
4 report?"

5 A. "Not that I recall right now."

6 Q. Okay. You and Mr. Lovett began your conversation
7 of these figures with a discussion of figure 6 from
8 Dr. Garabrant's report.

9 Do you recall that?

10 A. We did, although if I can just clarify that at this point
11 in the deposition when you asked about any other opinions, we
12 had already discussed table 2. So when I said I didn't have
13 other opinions about the report, it wasn't other -- just other
14 than those figures; it was also including table 2.

15 Q. I understand that, but table 2, our discussion didn't
16 talk about the scale or anything related to these figures, did
17 it?

18 A. Correct. Table 2 is a different topic.

19 Q. Correct.

20 A. But I did have opinions about -- I just wanted to make
21 clear that this wasn't referring to table 2.

22 Q. Thank you.

23 A. You're welcome.

24 Q. Mr. Tyree, could you pull up Defendant's Exhibit 32?

25 Now, you and Mr. Lovett skipped straight to figure 6 and

Wing - Cross

1 didn't talk about figure 5.

2 What is this figure looking at, Dr. Wing?

3 A. This figure presents the relationship between the percent
4 of sites with Ephemeroptera -- that's on the vertical axis --
5 and conductivity on the horizontal axis according to the
6 catchment area in square kilometers for three categories of
7 catchment area.

8 Q. Okay. And at conductivities of 1500, how often do we
9 find mayflies in the larger streams? That's the green line.

10 A. So at conductivities of greater than 1500, which is the
11 last data point on the right --

12 Q. I'm sorry. I'm sorry, Dr. Garabrant [sic]. In the range
13 of twelve -- let me -- may I approach, Your Honor?

14 THE COURT: You may.

15 BY MR. HARVEY:

16 Q. Dr. Wing, here at conductivities of -- would you agree
17 with me this is somewhere in the 1200-to-1500 range?

18 A. That is the category, 1200 to 1500.

19 Q. Okay. And according to Dr. Garabrant's graph, how often
20 do we find Ephemeroptera at those conductivity ranges? What
21 percent of the time?

22 A. In that group, there are -- the percentages range from
23 roughly 50 percent in the catchment group zero to 15.5 to a
24 hundred percent in the catchment group greater than 155 square
25 kilometers.

Wing - Cross

1 Q. That's a large difference based on stream size, correct?

2 A. It's -- between 50 percent and 100 percent is a large
3 difference, and it's -- the interpretation of that difference
4 depends in part on the sample size. So if there were only two
5 observations, or three, there would be different -- it would
6 be important to note and compare, for example, if there were
7 hundreds of observations.

8 Q. But this is one of those areas whereas you testified it
9 could be important, correct?

10 A. It could be important depending on sample size, the
11 precision of the estimates here.

12 MR. HARVEY: Okay. Just a minute, Your Honor.

13 BY MR. HARVEY:

14 Q. A couple of small finishing points, Dr. Wing.

15 Do you still have Plaintiffs' Exhibit 167 with you?

16 A. Would that be in the binder? Oh, plaintiffs' exhibit?

17 MR. HARVEY: May I approach, Your Honor?

18 THE COURT: You may.

19 THE WITNESS: These are joint exhibits. This is
20 defendant's exhibits.

21 MR. HARVEY: You and Mr. Lovett had it earlier. I'm
22 trying to help you find it here. I don't think we have it
23 now.

24 May I approach, Your Honor?

25 THE COURT: Yes, you may.

Wing - Cross

1 BY MR. HARVEY:

2 Q. Dr. Wing, this is Plaintiffs' Exhibit 167. Earlier,
3 Mr. Lovett had you read part of this paragraph.

4 Do you recall that?

5 A. I do.

6 Q. Okay. He had you read the last half of the paragraph.
7 Do you recall that?

8 A. I do.

9 Q. Can you read the full paragraph for me?

10 A. Yes, I can read the full paragraph.

11 "Close analysis of the Supreme Court decision reveals a
12 series of concerns. The requirements *Daubert* imposes on
13 federal judges are unreachable - no absolute criteria exist
14 for assessing the validity of scientific evidence. Scientific
15 reasoning is no more susceptible to a mechanical approach than
16 legal reasoning. Checklists of criteria, although appealing
17 in their convenience, are inadequate tools for assessing
18 causation. Alternatively, judges may rely on their own
19 experience and 'common sense,' which has inherent biases and
20 limitations."

21 Q. Okay. And how is that article described at the very top
22 caption of the article? What is that?

23 A. It's an editorial.

24 Q. Okay. So Plaintiffs' Exhibit 167 is essentially an
25 editorial complaining about the difficulty in meeting the

Wing - Cross/Redirect

1 *Daubert* process, correct?

2 A. I wouldn't describe it as complaining.

3 Q. Okay. They would like the standard to be changed,
4 correct?

5 A. It's an analysis of logical problems in the *Daubert*
6 decision or the *Daubert* rule.

7 MR. HARVEY: Okay. Just a minute, Your Honor.

8 THE COURT: Yes.

9 MR. HARVEY: Thank you, Dr. Wing. No further
10 questions.

11 THE COURT: All right. Any redirect?

12 MR. LOVETT: Very brief, Your Honor.

13 REDIRECT EXAMINATION

14 BY MR. LOVETT:

15 Q. Dr. Wing, Mr. Harvey asked you if you had an opportunity
16 to analyze EPA data. Do you recall that?

17 A. I do.

18 Q. And you said, "Yes, I had the opportunity," but you
19 didn't do it, right?

20 A. Well, I didn't -- I said I didn't ask for the data.

21 Q. Why wouldn't you have asked for it?

22 A. I'm not an ecologist.

23 Q. So the data -- you wouldn't have felt competent to
24 analyze the data on your own, right?

25 A. Correct.

Wing - Redirect

1 Q. Let's turn to figure 5 which Mr. Harvey just asked you
2 about. It's Defendant's Exhibit 30-something.

3 May I approach, Your Honor?

4 THE COURT: You may.

5 BY MR. LOVETT:

6 Q. So figure 5 is Defendant's Exhibit 32.

7 Do you remember Mr. Harvey asking you questions about
8 that just now?

9 A. Yes.

10 Q. And he asked you about the -- how often Ephemeroptera
11 occur in the twelve-to-fifteen-hundred range?

12 A. He did.

13 Q. You're not able to draw any conclusion about whether
14 that's an important finding or not from an ecological
15 perspective, are you?

16 A. No.

17 Q. You don't know what Ephemeroptera are, do you?

18 A. Well, I know they're macroinvertebrates.

19 Q. You don't know, for instance, if there are sensitive
20 Ephemeroptera and tolerant Ephemeroptera, do you?

21 A. I don't know.

22 Q. Because you're not an expert in ecology, right?

23 A. That's correct.

24 Q. It would take an expert in ecology really to understand
25 the importance of that figure, wouldn't it?

Wing - Redirect

1 A. It would.

2 Q. Okay. And, lastly, the editorial --

3 A. Yes.

4 Q. -- which is Plaintiffs' Exhibit 167, it is an editorial,
5 but as you stated, it's a very reputable journal, correct?

6 A. Correct.

7 Q. And it is -- do you understand it to be a group of
8 scientists giving their opinion about how courts should use
9 *Daubert*?

10 A. I can explain that this is an editorial written by David
11 Michaels who was invited to be a special editor of this
12 supplement to the *American Journal of Public Health* devoted to
13 the topic of the *Daubert* rule and how scientific evidence is
14 considered by courts.

15 MR. LOVETT: Okay. Thank you, Your Honor. That's
16 all I have.

17 THE COURT: All right. Any other questions?

18 MR. HARVEY: No follow-up, Your Honor.

19 THE COURT: All right. Thank you, Doctor. You may
20 step down.

21 Do you want to leave this notebook up here, Mr. Lovett,
22 or --

23 MR. LOVETT: Let me see what's up there, Your Honor.

24 THE COURT: All right.

25 MR. LOVETT: I doubt that we'll need it before

Palmer - Direct

1 lunch. We don't need this. (Indicating)

2 Call a witness?

3 THE COURT: Yes.

4 MR. LOVETT: Call Dr. Margaret Palmer.

5 MR. BECHER: She's currently sequestered, Your
6 Honor. I'll have to go downstairs to fetch her.

7 THE COURT: All right. That's fine.

8 Doctor, if you'll step up here, my clerk will administer
9 the oath.

10 MARGARET PALMER, PLAINTIFFS' WITNESS, SWORN

11 DIRECT EXAMINATION

12 BY MR. LOVETT:

13 Q. Good morning, Dr. Palmer. Would you state your name,
14 please?

15 A. Margaret Palmer.

16 Q. And you have open before you Plaintiffs' Exhibit 33,
17 which is your CV, I believe.

18 A. Yes.

19 Q. Did you prepare that CV?

20 A. I did.

21 Q. Is it an accurate representation of your education and
22 experience?

23 A. It is.

24 Q. Are there any -- when was it prepared?

25 A. I don't remember the exact date, but it was when I

Palmer - Direct

1 submitted the first testimony for this.

2 Q. Several months ago?

3 A. Oh, yes, yes, several months.

4 Q. And have you -- are there publications that you'd like to
5 tell the Court about since the preparation of the resume or
6 CV?

7 A. So do you want me to tell you what has been published?

8 Q. Yeah. What are among the more important publications
9 that you've published since the CV was prepared?

10 A. Well, I had a paper on restoration that was in *Science*.
11 I had a --

12 Q. *Science Magazine*?

13 A. Yes.

14 Q. *Science Journal*?

15 A. *Science Journal*, yes. I had a paper on temporary streams
16 that was also in *Science*. I had a paper on the outcome of
17 mining mitigation projects that was in *Environmental Science*
18 *and Technology*.

19 Q. Okay.

20 A. I had a paper that was on the flux of dissolved organic
21 carbonate and its composition below -- and in temporary
22 streams below restored wetlands. I had a paper that was on
23 the efficiencies of different types of best management
24 practices in urban watersheds.

25 Q. Okay.

Palmer - Direct

1 A. And I had, I think, a paper in -- I think this was before
2 this; was in the *Proceedings of the National Academy* on
3 basically the use of types of hydrologic modeling in
4 estimating the effect of reforestation on water flow.

5 Q. Okay. Let's just talk briefly about one of those, which
6 is that you said that you published an article in
7 *Environmental Science and Technology* I believe on mitigation
8 outcomes related to surface mining in Appalachia?

9 A. That's correct.

10 Q. And did that deal with conductivity at all?

11 A. Yes, it did.

12 Q. What did it conclude?

13 A. That the vast majority of the mitigation projects that
14 were being done to mitigate for surface mining were failures.

15 Q. And did that have something to do with conductivity?

16 A. Yes, conductivity. There were data on conductivity for a
17 subset of the mitigation reports, as well as there was
18 biological data for a subset of the mitigation reports.

19 So these are reports prepared and submitted by the coal
20 company to the Army Corps of Engineers.

21 Q. Now, you've testified before this Court before, haven't
22 you?

23 A. I have.

24 Q. And since -- I mean, how long has that been going back?

25 A. Almost 10 years.

Palmer - Direct

1 Q. Almost 10 years.

2 And in that 10 years, or nearly 10 years, you've followed
3 the science around coal mining in Appalachia extremely
4 carefully, haven't you?

5 A. I have.

6 Q. In fact, you've published on it yourself, right?

7 A. A little, yes.

8 Q. Okay. Did this Court qualify you as an expert in aquatic
9 ecology in the past?

10 A. It has.

11 Q. And you're still a professor at the University of
12 Maryland?

13 A. I am.

14 Q. Obviously you still do research there, right?

15 A. I still do research in addition to directing the center I
16 run, but, yes, I have an active group of graduate students and
17 we do research.

18 Q. You have a lab as well as a center.

19 A. That's correct.

20 Q. You've published hundreds of papers on aquatic ecology in
21 peer-reviewed journals?

22 A. That's correct.

23 Q. And also you mentioned briefly the Socio-Economic
24 Synthesis Center, right? You run that?

25 A. Socio-Environmental Synthesis Center. Yes, I do. I

Palmer - Direct

1 direct that.

2 Q. How is that funded?

3 A. By the National Science Foundation.

4 Q. And I believe you've testified here in the past that that
5 was funded with a \$50-million grant; is that right?

6 A. It was initially funded by a 27-1/2 million-dollar grant
7 for five years, and then we just had a major review and we've
8 been invited to send in a non-competitive renewal for
9 \$30 million. So it will be almost 60 million.

10 Q. Is a non-competitive renewal something you expect to get
11 unless something unusual happens?

12 A. Oh, yes, but it was a very, very rigorous review with
13 external evaluators over many days, so -- getting us to that
14 point.

15 Q. What is the purpose of the Socio-Economic Synthesis
16 Center?

17 A. The Socio-Environmental Synthesis Center is designed to
18 fund researchers from all over the world to come together in
19 small groups or teams, interdisciplinary teams, to address
20 problems using existing data and models.

21 Q. Okay. Now, you've said that you published on ionic
22 stress in Appalachian streams related to mining.

23 Have you also given presentations on that topic?

24 A. Yes, I've given some presentations, talks at universities
25 and a few presentations at national conferences on this.

Palmer - Direct

1 Q. To academic audiences?

2 A. Yes.

3 Q. Do you follow closely the literature in the area?

4 A. I do my best.

5 Q. And you've visited Appalachian streams how many times?

6 A. Many times. Not a lot of times to mine sites, but some,
7 but we have a home in West Virginia on a river, and so I was
8 there weekend before last, and I grew up going to those
9 streams.

10 Q. You're familiar with the benthic macroinvertebrates in
11 Appalachian streams?

12 A. Oh, yeah.

13 Q. How many times have you been to mine sites?

14 A. I think three times I want to say.

15 MR. LOVETT: Okay. I move to qualify Dr. Palmer as
16 an expert in aquatic ecology, particularly for this case as it
17 relates to ionic stress below surface mines.

18 THE COURT: All right. I'm satisfied she has the
19 necessary expertise. She can be cross-examined about her
20 qualifications.

21 BY MR. LOVETT:

22 Q. One question I -- did you just get an award last week?

23 A. I did.

24 Q. And what was that?

25 A. It was an Award for Excellence in Research by the Society

Palmer - Direct

1 for Freshwater Science.

2 Q. Is that an important society in your field?

3 A. Of course, yes.

4 Q. Yes. Okay.

5 So what is the most common scientific method for
6 measuring the health of freshwater streams in the United
7 States?

8 A. Well, throughout the United States and, in fact, in most
9 developed countries, the way it's measured and evaluated is by
10 taking samples of the benthic invertebrates and looking at
11 particularly species and genera that are known to be sensitive
12 to pollutants.

13 Q. And from those reviews comes stream condition indices
14 like the WVSCI or the GLIMPSS, right?

15 A. That's right. Those are West Virginia's, yes.

16 Q. And why are benthic macroinvertebrates particularly
17 useful for measuring stream health?

18 A. Well, for one thing, you know, they're in all streams
19 unless they are, you know, there's some sort of problem in the
20 stream, and then also because they are in the stream for
21 fairly long periods of time typically.

22 They basically -- you can think of them as averaging the
23 effects of changing conditions over that entire period that
24 they're in the stream. So they're sort of integrating the
25 effects over a long time period. And when I say long, I mean

Palmer - Direct

1 eight months to several -- many years, the larvae, before they
2 emerge as tracheal adults.

3 Q. So as an expert in the field of stream ecology, you
4 believe that the stream condition, benthic macroinvertebrates
5 stream condition indices are a valid way to measure stream
6 health.

7 A. Yes, I do.

8 Q. Okay. Let's turn to Plaintiffs' Exhibit 129, which is in
9 the same notebook, especially to pages 1487, 1489.

10 A. Yes.

11 Q. Do you see the sentence beginning the fourth paragraph,
12 "Using WVDEP's methodology"?

13 A. Yes.

14 Q. Would you read that sentence, please?

15 A. "Using WVDEP's methodology from the 2010 Section 303(d)
16 list, EPA considered waters with a WVSCI score greater than 68
17 as unimpaired. Waters with a WVSCI score below 60.6 were
18 placed on the list that EPA proposes to add to the Section
19 303(d) list."

20 Q. Okay. Let me ask you before -- I don't want to rush
21 through this too much. This is a letter from -- a May 25th,
22 2013 letter from EPA to Randy Huffman, Secretary of the State
23 DEP, right?

24 A. That's correct.

25 Q. Okay. And then if you would turn to page 1489 and read

Palmer - Direct

1 into the record, if you would, the paragraph beginning -- the
2 very first paragraph beginning, "Because."

3 A. "Because, as described above, EPA has determined that
4 West Virginia DEP's use of the 'gray zone' is statistically
5 unsupported, EPA finds that WVSCI scores from 60.6 to 68
6 indicate that waters do not achieve the West Virginia
7 narrative criteria as applied to the aquatic life uses."

8 Q. So EPA, did it adopt -- is it telling the state that it
9 must adopt a certain threshold for impairment under the WVSCI
10 index?

11 A. Yes. I mean, my interpretation of this is that the state
12 is to use 68, not anything lower, as an impairment index for a
13 303(d) listing.

14 Q. Okay. How is the WVSCI score determined generally?

15 A. Well, it's a multi-metric index, and it has a combination
16 of different sub-indices that look at things like the
17 composition of the community and the fraction of sensitive
18 species and things like that.

19 Q. And it's a family-based -- the WVSCI is a family-based
20 metric; is that correct?

21 A. It is. It's all at the family level.

22 Q. And did you -- do you know if EPA recommended for West
23 Virginia to move from a family-based metric to a genus-based
24 metric calls GLIMPSS?

25 A. I believe they have, and GLIMPSS has been developed and

Palmer - Direct

1 has been validated.

2 Q. Okay. And that's just a more -- I think we've heard it
3 described in this court as a finer tool that would allow a
4 more accurate level of impairment.

5 Is that your view of it?

6 A. Yeah, I think I wouldn't just say more finer. It is more
7 appropriate because it doesn't mix sort of apples and oranges.
8 You can have multiple genera within a single family that have
9 extremely different kinds of tolerances and sensitivities.

10 Q. And how does a change in insect population affect the
11 aquatic environment as a whole?

12 A. Well, it has a very large impact. It's the base of the
13 food web for higher forms, such as fish. Also larger
14 invertebrates like crayfish and so forth rely on the benthic
15 invertebrates.

16 It also -- they are major players in terms of processing
17 particulate organic matter, leaves and material that, in fact,
18 that fall into streams. So you can have accumulation of
19 organic matter which can cause oxygen to crash if it's not
20 processed.

21 So there are a vast number of ways in which they
22 influence it.

23 Q. Does it affect bird populations, for instance?

24 A. Yeah. You asked about aquatic. There's also --

25 MR. MCLUSKY: I'm going to object at this point.

Palmer - Direct

1 Her report does not offer opinions about effects on birds,
2 fish, or anything other than bugs.

3 THE COURT: Is that right?

4 MR. LOVETT: Hold on, Your Honor.

5 No, it does discuss fish.

6 THE COURT: It does?

7 MR. LOVETT: Fish, yes. I'm not sure about birds.
8 It's just a general introduction.

9 THE COURT: Well, nonetheless, I'll sustain the
10 objection. It appears there wasn't any discussion or
11 identification of the effect on birds in the report, but
12 you're free to go on to other areas.

13 MR. LOVETT: Well, let me -- Mr. Becher will look.
14 If I find anything about birds, I'll come back. But otherwise
15 I'll skip over that.

16 THE COURT: Sure.

17 BY MR. LOVETT:

18 Q. What is alkaline mine drainage?

19 A. It's just drainage below a mine site that has a high pH,
20 alkaline waters.

21 Q. Okay. And what is ionic pollution?

22 A. It refers to water that has a high concentration of ions;
23 and in this case, it's things like sulfate, bicarbonate, all
24 the things we typically focus on with respect to this case.

25 Q. And what is conductivity?

Palmer - Direct

1 A. It's a measure of that ionic strength. In fact, it's
2 technically a measure of the ability of the water to conduct
3 an electrical current, but that's determined by ions.

4 MR. LOVETT: Well, the report, Your Honor, does say
5 that it -- the paper indicates that conductivity affects the
6 macroinvertebrates, resulting in impacts higher up the food
7 chain.

8 I mean, to me that includes birds, and it was a small
9 point.

10 MR. MCLUSKY: Your Honor, I don't doubt there's
11 background information in the report, but there's no opinions
12 in the report offered about this site.

13 MR. LOVETT: All she offered just now is an opinion
14 that this affects life higher up the food chain, the loss of
15 insects, like birds --

16 THE COURT: All right.

17 MR. LOVETT: -- which is essentially what her report
18 says, except it doesn't say "like birds."

19 THE COURT: All right.

20 BY MR. LOVETT:

21 Q. And what is the relationship between ionic pollution and
22 conductivity?

23 A. Well, the more ionic pollution, the higher the
24 conductivity.

25 Q. And are we only talking about -- let's limit ourselves --

Palmer - Direct

1 would you limit your testimony, please, to ionic pollution and
2 conductivity related to surface mining in the Appalachian
3 region?

4 A. Yes.

5 Q. And does that conductivity have a particular makeup,
6 generally, ionic composition?

7 A. Yeah. There's a fairly characteristic makeup of --
8 dominated by particularly sulfates but also bicarbonate and
9 often calcium, magnesium. There can be other constituents in
10 smaller amounts, like sometimes potassium, sometimes chloride,
11 little bit.

12 Q. Does surface mining in Appalachia create ionic pollution
13 and increased conductivity?

14 A. Yes, it does.

15 Q. Okay. And why?

16 A. Well, when -- so let's take, for example, when mining
17 occurs and the material is brought up from depths hundreds of
18 feet often and valley fills are formed or the material is just
19 left sitting on the surface. It hasn't been exposed to air
20 and water for a long time. And when it rains and there's
21 oxygen, you tend to mobilize these ions. Initially you
22 actually get something like sulfuric acid and then it's then
23 neutralized, and these constituents go into solution very
24 readily.

25 Q. And do high levels of ionic pollution and conductivity

Palmer - Direct

1 cause biological impairment?

2 A. They do.

3 Q. And is there any doubt that high levels of ionic
4 pollution and conductivity materially contribute to
5 impairment?

6 A. If my understanding of the word "material" is correct,
7 yes; and that is, that there is a strong relationship and
8 evidence of causation between high conductivity and
9 impairment.

10 Q. Okay. How does the ionic pollution and conductivity
11 cause impairment?

12 A. Well, the -- most all the evidence to date is pointing to
13 what we have long suspected, which is its osmoregulation, that
14 the organisms have a difficult time maintaining their water
15 balance, their ionic balance in their bodies, and that that
16 ultimately causes probably reduced reproduction but certainly
17 extirpation.

18 Q. How long have ecologists understood that salts are a
19 problem for osmoregulation, osmotic regulation?

20 A. Long before I was born.

21 Q. All right. But now the science is coming to this region
22 and showing that these insects are having the same kinds of
23 problems that were found with other organisms in the past?

24 A. Right. You can't take an organism from salt water and
25 put it in freshwater or vice versa. They can't osmoregulate.

Palmer - Direct

1 But now there is evidence that the actual mixtures that are
2 characteristic of these mines cause problems with the
3 organisms which aren't necessarily linked to a specific ion
4 but to the ionic strength, the total ionic strength.

5 Q. And does the presence or absence of those insects allow
6 ecologists to determine whether a stream is healthy or not?

7 A. That's correct.

8 Q. Has the relationship between surface mining and
9 biological impairment of downstream waters been, in your
10 opinion, definitively established in the scientific
11 literature?

12 A. I have at this point absolutely no doubt. There are so
13 many studies that have been done, using very different methods
14 and very different places that have all reached the same
15 conclusion.

16 Q. Peer-reviewed studies?

17 A. Peer-reviewed studies, all of them.

18 Q. Are there any peer-reviewed papers to the contrary?

19 A. I do not know of any.

20 Q. Okay. Well, I say peer-reviewed papers that have been
21 published to the contrary.

22 A. I don't know of any. I've not seen any.

23 Q. And as a scientist, when you see tens of journal
24 articles, peer-reviewed journal articles published, all
25 reaching the same conclusion based on different lines of

Palmer - Direct

1 reasoning, on the one side, and no peer-reviewed articles
2 published on the other, is that generally a good indication
3 that the science is a mature science reaching a conclusion
4 that's well-established in the scientific community?

5 A. Yes. And, in fact, I mean, one of the things we're
6 taught very early on as a scientist, that the strongest form
7 of inference you can make is if you have multiple ways to
8 reach the same conclusion, if you use multiple methods,
9 different kinds of experiments, observations, and particularly
10 if different people do this work so that you can eliminate
11 potential methodological differences that individuals might
12 impart.

13 Q. And you think the benchmark is good science, right?

14 A. I do.

15 Q. But it's only one of the methods that are used to -- have
16 been used to establish this relationship or this causal effect
17 between conductivity and impairment, right?

18 A. That's correct.

19 Q. And even the data that the benchmark relies on aren't
20 relied on by many of the other authors in this area, right?

21 A. Well, many of the papers that have come out with the same
22 sort of relationship have been experimental approaches,
23 have -- correct, they're not using the benchmark.

24 Q. Right. We'll go through this one to establish that early
25 on.

Palmer - Direct

1 Do you know about how many, just off the top of your
2 head, about how many peer-reviewed and published articles
3 there have been on the relationship between ionic stress and
4 impairment related to surface mining?

5 A. My guess would be somewhere between 25 and 30 now.

6 Q. Okay. And do you know about how many authors there have
7 been on those published peer-reviewed journal articles?

8 A. I haven't actually counted them up. My guess is over 50.
9 Maybe 60. I don't know.

10 Q. Have you reached an opinion about whether the scientific
11 literature establishes that there is a causal relationship
12 between surface mines in Central Appalachia and downstream
13 biological impairment?

14 A. I have.

15 Q. And what is your opinion?

16 A. My opinion is that the surface mines that have this
17 alkaline mine drainage in this part of the country result in
18 conductivity levels which exceed those that are able to
19 support the sensitive species, the species you'd expect to
20 find in those streams without the mining.

21 Q. Have you reached an opinion about whether the scientific
22 literature establishes that there is a causal relationship
23 between discharges of ionic mixture of high conductivity
24 alkaline drainage from mines in Central Appalachia and
25 downstream biological impairment?

Palmer - Direct

1 A. Yes, I have.

2 Q. And what is your opinion?

3 A. Well, my opinion is that the causative factor is the
4 elevated conductivity.

5 Q. Okay. What was the first publication that identified the
6 impacts of surface coal mining and conductivity on macro-
7 invertebrates in Central Appalachia?

8 A. I believe that probably -- well, there's three or four I
9 can think of right off the bat, and I would have to look to
10 see the exact dates. But there was a programmatic draft
11 Environmental Impact Statement. There was a paper by Hartman
12 that came out a good while ago. There was a U. S. --

13 Q. Let's stop. Let's start --

14 THE COURT: We're going to need to take a break at
15 some point. Is this a good time?

16 MR. LOVETT: Okay. Good place, Your Honor.

17 THE COURT: All right. We're going to take a
18 recess. We'll reconvene at 1:15.

19 You may step down, but don't discuss your testimony.

20 (Lunch recess from 12:06 p.m. to 1:18 p.m.)

21

22

23

24

25

Palmer - Direct

1 AFTERNOON SESSION

2 THE COURT: Ready to proceed?

3 MR. LOVETT: Yes, Your Honor.

4 THE COURT: Go ahead.

5 BY MR. LOVETT:

6 Q. Good afternoon, Dr. Palmer. We were just beginning to
7 talk about the scientific literature establishing the
8 relationship between conductivity and impairment, and I asked
9 you about the mountaintop mining valley fill EIS.

10 Do you recall that?

11 A. Yes.

12 Q. And that was published in 2003; is that right?

13 A. That sounds right.

14 Q. Okay. What did the EIS identify to be the downstream
15 impacts from valley fills?

16 A. They looked at a variety of things, but specifically
17 pointed out changes in water chemistry, including
18 conductivity, and also changes in biological, you know,
19 assemblages.

20 Q. And did it find an increased concentration of sulfates,
21 dissolved solids, TDS?

22 A. Yes, it did.

23 Q. Okay. And did the EIS also notice an increase in
24 specific conductance was associated with the decrease in
25 sensitive taxa in the streams?

Palmer - Direct

1 A. That's correct.

2 Q. Okay. So that was 2003, right?

3 A. Yes.

4 Q. And then in 2004, was there a paper by Kennedy et al.?
5 Do you recall that?

6 A. Yes. I wasn't positive of the exact date, but, yes, I
7 know the Kennedy paper. Yes.

8 Q. Do you know what that paper established?

9 A. I believe it was Kennedy and Cherry, and they did, as I
10 recall, maybe a combination of sampling, but they also exposed
11 organisms to elevated conductivity levels, elevated mixtures,
12 and showed, you know, loss of those.

13 Q. And then in 2005 did Hartman again show the specific
14 conductance was elevated below fills?

15 A. He did, and I think that was a field study --

16 Q. Uh-huh.

17 A. -- a laboratory study.

18 Q. Did he find that mayfly richness was affected?

19 A. Yes. Hartman did, yes.

20 Q. Okay. And then were you in this courtroom in 2006 when
21 Dr. Bruce Wallace testified in, I believe -- I can't remember
22 which case it was. Highland Reylas, maybe?

23 A. It was Aracoma.

24 Q. Aracoma? Okay.

25 A. I remember.

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1 Q. Okay. Were you here when he testified about
2 conductivity?

3 A. I did. I mean, I was.

4 Q. And what did he testify to?

5 A. He testified that --

6 MR. MCLUSKY: Your Honor, I object. This is
7 hearsay. She can rely on hearsay, but she can't parrot the
8 hearsay and bootstrap her way into it.

9 THE COURT: I agree.

10 BY MR. LOVETT:

11 Q. Okay. Did you read the opinion from the Court that came
12 from that hearing?

13 A. I did read that opinion.

14 Q. And you heard Dr. Wallace testify?

15 A. I heard him testify, yes.

16 Q. Okay. And did the Court's opinion cite Dr. Wallace's
17 testimony, if you recall?

18 A. It did cite Dr. Wallace's testimony.

19 Q. Okay. So then in 2008 there was a paper published by
20 Pond; is that correct?

21 A. Yes, in the *Journal of the North American Benthological*.

22 Q. Do you have the joint exhibits up there with you?

23 A. Yes.

24 MR. LOVETT: Your Honor, we have here, I think, an
25 agreed-to list of excerpts.

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1 THE COURT: I can't hear you very well.

2 MR. LOVETT: We have an agreed-to list of excerpts
3 by the parties, just to prevent Dr. Palmer and any other
4 witness from having to read extensive comments into the
5 record. So we've stipulated -- I believe this is right -- to
6 all of the parts that are in this, that are in this packet.

7 I'm going to have Dr. Palmer go through it quickly and
8 she'll note some parts of it, without having to read
9 everything. But all of the text that is reproduced here I
10 believe will be admitted into evidence without objection.

11 And so I think it's easier to go through the testimony
12 with this packet, rather than go through each paper itself.

13 THE COURT: All right. I have no problem with that.

14 Is this packet one -- is this going to be an exhibit?

15 MR. LOVETT: Yes. It will be Plaintiffs'
16 Exhibit 173.

17 THE COURT: And Plaintiffs' Exhibit 173 will consist
18 of, it looks like, three --

19 MR. LOVETT: No, this is three copies of 173. It's
20 essentially that. (Indicating)

21 THE COURT: All right. I've got you.

22 MR. LOVETT: Mr. McLusky has a problem.

23 MR. MCLUSKY: Your Honor, I think our understanding
24 of the agreement -- and there may be some misunderstanding --
25 we have no objections, to the extent these are otherwise

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1 admissible, that the written document come in rather than
2 taking time reading, but we do have problems with two or three
3 of these papers. I'm happy to take them up now or as they
4 come in.

5 THE COURT: It would be clearer for me if we dealt
6 with them as they came in and came up.

7 MR. MCLUSKY: If you'll give me a minute, I can tell
8 Mr. Lovett what they are.

9 THE COURT: That's fine.

10 (Mr. McLusky and Mr. Lovett conferred privately off the
11 record.)

12 MR. LOVETT: Let's just wait. I think it will be
13 easier.

14 May I approach, Your Honor?

15 THE COURT: You may.

16 BY MR. LOVETT:

17 Q. So at JE 0185 in Exhibit 173, you find the Pond, Passmore
18 et al. 2008 paper, correct?

19 A. I'm sorry? 875?

20 Q. It's the first paper in Exhibit 173. If you look at the
21 bottom at the page number --

22 A. I see 182.

23 Q. Really? It's not the first page? Do you see "Downstream
24 effects of mountaintop coal mining"?

25 A. That's it. At the bottom it says JE 185.

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1 Q. Yes, JE 185.

2 A. Oh, I'm sorry. I must have misunderstood you.

3 Go ahead. Sorry.

4 Q. Anyway, before you is an excerpt from the Pond article,
5 right?

6 A. Yes.

7 Q. You've read the whole article several times?

8 A. I have, yes.

9 Q. Okay. What does this article conclude?

10 A. He -- well, he looked at sites below mined areas and
11 valley fills and sites that were reference sites but were
12 unimpacted and concluded that there was strong evidence that
13 you had loss, you know, changes in species assemblages and
14 loss of taxa, particularly mayflies, and that that was
15 associated with water chemistry.

16 Q. So he found strong evidence of a causal link between
17 biological impairment and conductivity; is that right?

18 A. He concluded there was a link, yes.

19 Q. Okay. And he used a method different from the EPA
20 benchmark, didn't he?

21 A. Yes, he did, because this was direct field sampling,
22 comparing sites with and without mine and valley fills.

23 Q. He didn't rely on the DEP database at all.

24 A. No, he did not.

25 Q. The next -- anything else about this paper that's

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1 important?

2 A. Well, just that it's been cited a lot, good experimental
3 field work, taking a very different approach.

4 Q. All right.

5 A. Well, I should say he found 93 percent of the mine
6 streams were impaired, which is a large number.

7 Q. Let's turn to the next Pond article, which is a 2010
8 article at PE 1526.

9 Do you see that?

10 A. Yes.

11 Q. Okay. And did Pond there find that -- well, what did
12 Pond find?

13 A. Well, in this case he was specifically looking at loss of
14 mayflies --

15 Q. Uh-huh.

16 A. -- from streams in Kentucky.

17 Q. Uh-huh.

18 A. And what he showed was that -- so he looked across 92
19 sites, and a fraction of these were reference sites. Some of
20 them were mine sites and some were a combination of different
21 land uses, specifically residential development, mixed land
22 uses.

23 And in this, he shows that taxa richness, that is, the
24 number of different groups of mayflies and their relative
25 abundance, were much higher in reference sites compared to all

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1 the other categories, and that mine sites were significantly
2 lower than the other categories, even compared to residential
3 or mixed -- excuse me -- mined and residential sites.

4 Q. Okay. And did he find that the abundance of mayflies was
5 more closely related to conductivity than to habitat?

6 A. That's my recollection, yes.

7 Q. Okay. Again, did he use a data and method different from
8 the EPA benchmark?

9 A. He did. He, again, used a field-based approach, and he
10 went to a region that was totally different from his prior
11 study in 2008.

12 Q. Okay. The next paper is from *Science Policy Forum*.
13 You're an author of this paper, right? That's at "Mountaintop
14 Mining Consequences"?

15 A. That's correct.

16 Q. And what was the finding of this paper?

17 A. The paper put together material from a variety of
18 sources, as well as pulling data directly from DEP, and looked
19 at the relationship between water chemistry and mining and
20 also looked at the relationship between West Virginia indices
21 and mayflies and mining and showed that there was a
22 significant decline, you know, poor water quality, higher
23 conductivity, including the dissolved constituents, and fewer
24 taxa.

25 Q. Including a decline in mayflies, right?

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1 A. Yes, including a decline in mayflies.

2 Q. And, again, did that use the -- did that rely on the DEP
3 database or on the benchmark?

4 A. We did use some of the DEP database data for that, but,
5 no, we didn't use the benchmark. We didn't have the
6 benchmark.

7 Q. You didn't sort the DEP database or use it in the same
8 way that the EPA did when it came up with the benchmark, did
9 it -- did you?

10 A. We did not. We were not looking for threshold effects or
11 anything like that.

12 Q. The next paper is 1667.

13 No. Let's see. That's not for this. That's for the
14 next witness. I'm sorry.

15 Let's go on to JE 0162, the Merriam paper.

16 MR. MCLUSKY: What was the page, Joe?

17 BY MR. LOVETT:

18 Q. I thought we had this down. I'm trying to find it in
19 this notebook.

20 You have to skip way ahead to JE 0 --

21 A. I did find it.

22 Q. -- 162. Did you find it?

23 A. Yes.

24 Q. Okay. It's Merriam et al.?

25 A. Yes.

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1 Q. Okay.

2 THE COURT: Where did you find it?

3 THE WITNESS: It was after that one that he said was
4 for another witness. So it was after PE 1720.

5 MR. LOVETT: There are many pages, Your Honor,
6 between the last exhibit and this one.

7 THE COURT: All right. Go ahead.

8 BY MR. LOVETT:

9 Q. Okay. Anyway, this is called "Additive effects of mining
10 and residential development on stream conditions in central
11 Appalachia" by Merriam et al., right?

12 A. Yes.

13 Q. Published where?

14 A. This was published in the *Journal of the North American*
15 *Benthological Society*.

16 Q. Okay. A peer-reviewed journal?

17 A. Yes, very rigorous.

18 Q. All the previous papers were also peer-reviewed journals;
19 is that right?

20 A. That's correct.

21 Q. Thank you.

22 And what did Merriam find?

23 A. Well, they -- once again, they looked at the combined
24 effects of -- well, distinguished between mined -- streams
25 that had mining in the watershed versus ones that had some

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1 form of development and mining versus ones that did not. And
2 they found that both had impacts, some impacts; but when you
3 looked at mining and residential or development, that there
4 were additive effects, and so both were contributing to
5 changes in the community structure.

6 Q. So another article essentially confirming the theory that
7 you've testified here about the linkage between conductivity
8 and impairment, right?

9 A. That's correct.

10 Q. And, again, this did not rely on the DEP database or on
11 the methodology used in the benchmark, right?

12 A. That's correct.

13 Q. Okay. Next, let's turn to -- that's the benchmark.
14 Okay.

15 All right. We're going to use the entire -- the
16 benchmark is a joint exhibit, and so I apologize for going
17 back and forth in the notebooks. But if you'd turn to the
18 joint exhibits, it is Exhibit --

19 MR. HECKER: 17.

20 BY MR. LOVETT:

21 Q. -- 17. Do you recognize that?

22 A. Yes.

23 Q. And that's the EPA benchmark, correct?

24 A. Correct.

25 Q. Okay. You've read the benchmark and are very familiar

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1 with it; is that right?

2 A. I have.

3 Q. And do you believe the benchmark is good science?

4 A. I do think it's very good science.

5 Q. Okay. This is the first time that -- so we're now in
6 2011, and we started in 2002, and this is the first time that
7 the DEP database has been used in the way that Dr. Garabrant
8 criticized the other day, yesterday; is that right?

9 A. That's correct.

10 Q. Okay. Do you believe that even before the benchmark came
11 out, there was a link established in the published literature
12 between conductivity and impairment in Appalachian headwater
13 streams as related to surface mining?

14 A. There was established such a relationship.

15 Q. What did the benchmark find, generally?

16 A. Well, the benchmark generally found that when
17 conductivity was, you know, below 300, that this was
18 protective of about 95 percent of the genera.

19 Q. Okay. Let's turn to page A36.

20 THE REPORTER: I'm sorry. Did you say "A36"?

21 MR. LOVETT: A36.

22 THE WITNESS: Okay.

23 BY MR. LOVETT:

24 Q. Is it the table we looked at --

25 (Mr. Lovett and Mr. Hecker conferred privately off the

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1 record.)

2 BY MR. LOVETT:

3 Q. This is the table we've looked at several times in this
4 courtroom, right?

5 A. I think so, yes.

6 Q. And the last sentence above that, could you read that,
7 please?

8 A. "At the benchmark of 300" --

9 Q. No, no, I'm sorry. It starts, "Using logistic
10 regression." It's the sentence that is just before the figure
11 A-9. Maybe you're on the wrong page.

12 A. Yes, I found it.

13 Q. Okay.

14 A. "Using logistic regression, the probability of impairment
15 at 500 microsiemens per centimeter is .72."

16 Q. And?

17 A. "And at 300 microsiemens, it's .59."

18 Q. So that means that when stream levels reach 300
19 microsiemens per centimeter, it's 59 percent likely that there
20 will be impairment.

21 A. Correct.

22 Q. Is that right? And that when it reaches 500 microsiemens
23 per centimeter, it's 72 percent likely.

24 A. Yes.

25 Q. And that continues, that percentage continues to increase

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1 as the conductivity increases, right?

2 A. That's correct.

3 Q. Did the benchmark consider -- strike that. I don't want
4 to be cumulative, and I think Dr. -- I think we'll have
5 testimony about that later.

6 So let's turn to the next exhibit, which is the EPA
7 Scientific Advisory Board review of the benchmark. And that
8 should be attached -- part of the same exhibit, I think.

9 No, I'm wrong.

10 (Mr. Lovett and Mr. Hecker conferred privately off the
11 record.)

12 BY MR. LOVETT:

13 Q. Plaintiffs' 128, which is the SAB review of the
14 benchmark, do you see that?

15 A. Yes.

16 Q. Okay. On page 1 -- this is a letter from EPA. It's in
17 the form of a letter from EPA, right, to -- from the
18 Scientific Advisory Board to the administrator of EPA?

19 A. That's correct.

20 Q. Would you read the last paragraph on that page?

21 A. "Mountaintop mining and valley fills are important
22 sources of stress to aquatic systems in the Central
23 Appalachian region, both from the perspective of localized and
24 cumulative regional impacts. In a companion report, the Panel
25 provides a review of EPA's assessment of the impacts

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1 associated with mountaintop mining and valley fills. There is
2 clear evidence that valley fills are associated with increased
3 levels of conductivity associated with changes in the
4 composition of stream biological communities."

5 Q. Okay. I think you might have missed a line there.

6 A. I missed a line?

7 Q. All right. Does yours say, "There is clear evidence that
8 valley fills are associated with increased levels of dissolved
9 ions"?

10 A. Yes. Yeah. I'm sorry. I guess I spaced -- "There is
11 clear evidence that valley fills are associated with increased
12 levels of dissolved ions (measured as conductivity)" --

13 Q. Okay.

14 A. -- "in downstream waters, and that these increased levels
15 of conductivity are associated with changes in the composition
16 of stream biological" --

17 Q. I just wanted to make sure we were reading from the
18 same --

19 A. Sorry.

20 Q. Okay. And then I don't want to ask you to read that much
21 from this, but it's an important document. So there are two
22 or three passages.

23 Would you read the next sentence, please? "The SAB
24 applauds."

25 A. "The SAB applauds the Agency's efforts to assess the

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1 linkages between measured levels of conductivity and the
2 presence or absence of native aquatic insects in Appalachian
3 streams. The field-based methodology for establishing a
4 conductivity benchmark provides greater realism than
5 traditional laboratory-based methods because it includes
6 native taxa and a range of life stages."

7 Q. Okay. So EPA was aware of the fact that the benchmark --
8 or the Scientific Advisory Board was aware that the benchmark
9 was not based on laboratory data, right?

10 A. That's correct.

11 Q. They actually saw that as a benefit.

12 A. They did.

13 Q. Okay. And then would you turn to page 3, please, and
14 read the first sentence of the -- the first two sentences of
15 the "Causality between Extirpation and Conductivity" section.

16 A. Beginning, "The field-based approach"?

17 Q. No, beginning "Building a strong case." It's page 3.

18 A. I don't believe I have that.

19 Q. Do you have page 3 of that letter?

20 A. Well, it goes 1419 to 1420.

21 (Mr. Hecker and Mr. Lovett conferred privately off the
22 record.)

23 BY MR. LOVETT:

24 Q. Okay. I'm sorry. Would you turn to tab 128 in the
25 plaintiffs' exhibits?

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1 THE COURT: I think this is tab 128.

2 THE WITNESS: That's what we were on.

3 BY MR. LOVETT:

4 Q. Are you in the plaintiffs' exhibits? Now you're not.

5 A. I am.

6 (Mr. McLusky and Mr. Lovett conferred privately off the
7 record.)

8 BY MR. LOVETT:

9 Q. Turn to page 1431, please.

10 A. Okay.

11 Q. Now, this is a different document. It's the -- this is
12 the Panel statement itself, right? Starts on 1422?

13 A. Yes, that looks to be the case. Yes.

14 Q. Would you read the sentence, then, that says, "Building a
15 strong case"?

16 A. It's entitled "Causality between Extirpation and
17 Conductivity."

18 "Building a strong case for causality between
19 conductivity and loss of genera requires that two linkages be
20 demonstrated: (1) a strong relationship between stream
21 conductivity and the amount of mountaintop mine valley fill in
22 the upstream catchment, and (2) a strong relationship between
23 elevated stream conductivity and loss of benthic macro-
24 invertebrate taxa. The EPA document presents a convincing
25 case for both linkages. To further strengthen the scientific

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1 basis for the benchmark, the Panel recommends that the
2 document include more information on the constituent ions that
3 contribute to conductivity at the sampled sites, and on the
4 likely mechanisms of extirpation produced by the constituent
5 ions."

6 Q. Okay. Do you agree that the benchmark builds a -- that
7 there has been a strong relationship shown between stream
8 conductivity and the amount of mountaintop removal valley
9 fills in the upstream catchment?

10 A. Yes.

11 Q. Do you also agree that there has been a strong
12 relationship shown between elevated stream conductivity and
13 the loss of benthic macroinvertebrate taxa?

14 A. Yes, it does.

15 Q. EPA recommends strengthening it by including more
16 information on the constituent ions, right?

17 A. They did.

18 Q. Has that been done since then?

19 A. Yes. It's in the final benchmark report.

20 Q. Okay. And would you turn lastly to the next page, 1432,
21 where -- and read the last -- the full paragraph there
22 beginning, "The Panel recommends."

23 A. You mean "The Panel concluded"?

24 Q. "Concluded." I'm sorry.

25 A. "The Panel concluded that the field-based method used to

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1 develop the conductivity benchmark was quite general and
2 sufficiently flexible to allow the approach (though not the
3 benchmark value) to be transferred to other regions with
4 different ionic" --

5 Q. I'm sorry. I had the wrong -- the next paper in the
6 Exhibit 173 is Bernhardt et al. at JE 0001.

7 A. Yes.

8 Q. Are you familiar with this paper?

9 A. I am.

10 Q. And are you co-author of it?

11 A. Yes.

12 Q. When was it published?

13 A. It was published in 2011.

14 Q. And where was it published?

15 A. *The Annals of the New York Academy of Sciences.*

16 Q. What did it conclude?

17 A. Pardon me?

18 Q. What did it conclude?

19 A. It concluded that there was a significant relationship
20 between mining and chemical changes in the water and streams
21 below these and that that was strongly associated with
22 biological impairment.

23 Q. Okay. Did that rely on the same methodology and data
24 that the benchmark did?

25 A. No, it didn't. This was really more of a synthesis of

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1 studies and summarizing the evidence.

2 Q. Okay. Next is PE 1759 in the same exhibit, "Cumulative
3 impacts of mountaintop mining on an Appalachian watershed" by
4 Lindberg, Bernhardt et al.?

5 A. Yes.

6 Q. Okay. Are you familiar with that paper?

7 A. I've read it, yes.

8 Q. Okay. Can you turn to page 1761, and you'll see there a
9 series of figures, and explain those figures to the Court.

10 A. Well, this study was particularly compelling because they
11 went into a watershed to sample where they could look at
12 sub-watersheds of the overall watershed that had different
13 amounts of mining. And as they moved to larger and larger
14 watersheds, basically they were getting a larger fraction of
15 the watershed area mined. But they sampled each of those
16 points separately.

17 And so they were able to show that as you go from
18 essentially no mining, all the way up to a watershed that's
19 extensively mined by an aerial measurement, that the -- you
20 had tremendous changes in sort of an almost additive way. It
21 asks -- it appears that at some point, although it's not for
22 sure, conductivity increases, sulfate increases, and generally
23 selenium increased.

24 So the relationship between conductivity and the percent
25 of the watershed mined was highly significant. And the same

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1 with sulfate and selenium.

2 Q. And why is that important?

3 A. Because it clearly establishes the cumulative impacts;
4 the more and more area that's mined in a watershed, the worse
5 the conditions get.

6 Q. Okay. Again, did this rely on the methodology from EPA?

7 A. It did not. This was direct field sampling in a way that
8 had not been done previously.

9 Q. Okay. Next paper, 1765, Pond paper.

10 Oh, by the way, where was that last paper published?

11 A. I believe *Proceeding of the National Academy of Science*.

12 Q. Okay. Peer-reviewed?

13 A. Very rigorously.

14 Q. All right. Pond 2011, do you see that one?

15 A. Yes.

16 Q. What did that paper show?

17 A. Well, this is another example of Pond going into
18 Kentucky, and this time the focus was largely looking at
19 stoneflies and caddisfly communities in headwater streams and
20 looking at the relationship between both coal mining and
21 residential development, that is, disturbance to the land, and
22 what happens to stoneflies and caddisflies.

23 And he showed that the core caddisfly genera were
24 extirpated from most of the disturbed sites, but he also
25 remarked that there were no habitat factors that were really

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1 able to explain this pattern.

2 Q. And is this based on field sampling that Pond performed?

3 A. That's my recollection.

4 Q. Not on -- obviously, not on the West Virginia --

5 A. It's not, correct. Correct. And I don't -- it's not
6 based on a Kentucky database to my knowledge at all. I'd have
7 to go look.

8 Q. So it's science done independent from the benchmark.

9 A. Correct.

10 Q. Reaching the same conclusion as the benchmark.

11 A. Pardon me?

12 Q. Reaching the same conclusion as the benchmark.

13 A. Reaching exactly the same conclusion.

14 Q. The next paper is another Pond paper, at PE 1786,
15 "Calibration and validation of a regionally and" --

16 THE REPORTER: I'm sorry. Say that again.

17 MR. LOVETT: Let's just call it "Calibration and
18 Validation" paper.

19 BY MR. LOVETT:

20 Q. Do you see that one?

21 A. Yes, I do.

22 Q. Where was that published?

23 A. This was published in *Environmental Monitoring and*
24 *Assessment*.

25 Q. Okay. A good journal?

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1 A. It is a good journal.

2 Q. And what did it find?

3 A. It was describing the development and also the validation
4 of a genus-level index for assessing streams in West Virginia.

5 Q. And did it essentially find that GLIMPSS is better than
6 WVSCI in detecting impairment and loss of taxa?

7 MR. MCLUSKY: Your Honor, I question the relevance.
8 I think the Court has previously ruled that WVSCI is the
9 appropriate test in these cases. It may be of some interest,
10 but I don't know that it's --

11 THE COURT: Well, we'll see what the plaintiff is
12 trying to do with it.

13 MR. MCLUSKY: I think he may be finished.

14 THE COURT: Overruled.

15 THE WITNESS: Yeah, the reason it was significant
16 was just pointing out that a genus-level index is much more
17 appropriate to use because the family-level index is not
18 adequately sensitive enough because it lumps genera that have
19 very different tolerance levels.

20 BY MR. LOVETT:

21 Q. Let's next turn to JE 0020.

22 A. Yes.

23 Q. "How Many Mountains" by Bernhardt et al., right?

24 A. Yes.

25 Q. And what did that paper find?

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1 A. Well, they looked at the relationship between the area
2 surface mines. This was done through mapping using GS spatial
3 analysis. There was a relationship between that and the water
4 chemistry, specifically the ionic strength and also the
5 sulfate concentrations.

6 Q. Okay. And let me have you read from the abstract the
7 last sentence from the abstract.

8 A. "We find this" --

9 Q. Well, read the sentence before, "Generalized additive
10 models."

11 A. "Generalized additive models were used" --

12 Q. Sorry.

13 A. Is that right?

14 Q. Yes, you're right. I'm sorry.

15 A. "Generalized additive models were used to estimate the
16 amount of watershed mining, stream ionic strength, or sulfate
17 concentrations beyond which biological impairment (based on
18 state biocriteria) is likely. We find this threshold is
19 reached once surface coal mining -- mines occupy more than
20 5.4 percent of their contributing watershed area, ionic
21 strength exceeds 308 microsiemens per centimeter, or sulfate
22 concentrations exceed 50 milligrams per liter."

23 Q. Okay. So the 308 microsiemens per centimeter number is
24 slightly different from the EPA benchmark but essentially the
25 same; is that fair?

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1 A. Yes, it is, remarkably similar.

2 Q. And that number was reached using a different methodology
3 from the one used by EPA in the benchmark; is that right?

4 A. That's correct.

5 Q. Though it did rely on data from the DEP database, they
6 used it in a different way.

7 A. Yes. They didn't generate the -- determine the threshold
8 using the same methods. They used --

9 Q. Is it also --

10 A. -- TITAN it's called.

11 Q. I'm sorry. Would you also turn to the next page, JE 022?

12 A. Yes.

13 Q. And then there's a -- on the gray squares on the
14 right-hand column, after the second gray square, there's a
15 sentence beginning, "Finally, GAMS." Do you see that? Would
16 you read that, please?

17 A. "Finally, GAMs, general additive models, allowed us to
18 model the stressor-response relationship after controlling the
19 effect of instream habitat quality, a variable that influences
20 community metrics independently of catchment mining and stream
21 chemistry."

22 Q. Okay. So this paper found that even -- that it
23 eliminated habitat as the cause, right?

24 A. Well, it took it into account, yes, and eliminated it
25 statistically; that's right.

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1 Q. And that's just what the benchmark did too, didn't it?

2 A. Well, the benchmark was able to determine that habitat
3 was a confounding factor that was a problem using a variety of
4 approaches, one of which was statistical, yes.

5 Q. Okay. So this is consistent with the benchmark.

6 A. It is consistent, yes.

7 Q. All right. The next paper is PE 1812, Cormier and Suter.

8 A. Is it in this packet?

9 Q. It should be, right after "How Many Mountains" in the
10 packet. "A Method for Deriving Water-Quality Benchmarks."

11 A. I found it.

12 Q. Now, there's a series of papers from Cormier and Suter
13 that have much of the data in them from the benchmark, right?

14 A. Correct.

15 Q. We'll go through these quickly.

16 The first one is "A Method for Deriving Water-Quality
17 Benchmarks."

18 What does that paper show?

19 A. It's essentially describing the method that allowed them
20 to use data, observational data from the field, on genera and
21 estimate the point at which 5 percent are adversely affected.

22 Q. Would you --

23 A. It describes the method.

24 Q. Would you read the last sentence from the abstract
25 beginning "Observations."

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1 A. "Observations from field studies include the full range
2 of conditions, effects, species, and interactions that occur
3 in the environment and can be used to model some causal
4 relationships that laboratory studies cannot."

5 Q. Okay. And where is it published?

6 A. This is published in *Environmental Toxicology and*
7 *Chemistry*.

8 Q. Okay. Let's move on to the next one, "Derivation of a
9 Benchmark."

10 A. Yes.

11 Q. Do you remember what that paper generally does?

12 A. This talks more specifically about how they develop the
13 benchmark for specific conductance, which was a measure of the
14 ionic strength, and specifically the benchmark that would
15 prevent extirpation of about 95 percent of the species in the
16 specific setting they were referring to, the alkaline mine
17 drainage.

18 Q. And like the benchmark, it set that level at 300
19 microsiemens per centimeter; is that --

20 A. That's correct.

21 Q. The next one is "A Method for Assessing Causation of
22 Field Exposure-Response Relationships."

23 Do you see that one?

24 A. Yes.

25 Q. Okay. And -- but do you remember what's the importance

Palmer - Direct

1 of this paper?

2 A. Well, this was another methods description paper; and in
3 this case, they're talking about use of the weight of evidence
4 system, which is --

5 Q. Uh-huh.

6 A. It's similar to what I referred to earlier when I said
7 the best science is when you approach something from a variety
8 of different directions. But in this case, the idea is that
9 multiple lines of evidence are used to establish causation, in
10 this case the relationship between conductivity and impairment
11 or loss of taxa.

12 Q. Okay. Next, let's turn to "Assessing Causation of the
13 Extirpation of Stream Macroinvertebrates by a Mixture of
14 Ions."

15 A. Okay.

16 Q. Okay. Would you read the first, say, half or little more
17 than half of the abstract?

18 A. "Increased ionic concentrations are associated with the
19 impairment of benthic invertebrate assemblages. However, the
20 causal nature of that relationship must be demonstrated so
21 that it can be used to derive a benchmark for conductivity.
22 The available evidence is organized in terms of six
23 characteristics of causation: co-occurrence, preceding
24 causation, interaction, alteration, sufficiency, and time
25 order. The inferential approach is to weight the lines of

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1 evidence using a consistent scoring system, weigh the evidence
2 for each causal characteristic, and then assess the body of
3 evidence. Through this assessment, the authors found that a
4 mixture containing the ions calcium, magnesium, bicarbonate,
5 and sulfate as measured by conductivity, is a common cause of
6 extirpation of aquatic macroinvertebrates in Appalachia where
7 surface coal mining is prevalent."

8 Q. Thank you. And would you turn to the last page of that,
9 on JE 088?

10 A. Okay.

11 Q. Do you see the conclusion?

12 A. Yes.

13 Q. Would you read the first sentence of the conclusion?

14 A. "The evaluation of the body of evidence showed that the
15 available evidence supports a causal relationship between
16 mixtures of matrix ions in streams of ecoregions 68, 69, and
17 70 and resulting biological impairments."

18 Q. And do you agree with that conclusion based on the papers
19 that -- at least that paper and the paper that preceded it by
20 Suter and Cormier?

21 A. I do agree with that, yes.

22 Q. The next one is "A Method for Assessing the Potential for
23 Confounding Applied to Ionic Strength in Central Appalachian
24 Streams."

25 Do you see that one?

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1 A. Yes.

2 Q. Would you turn to JE 0094, please?

3 A. Okay.

4 Q. Do you see the sentence in the second column beginning,
5 "Habitat score"?

6 A. "Habitat score had a very slight effect on the intercept
7 and the slope for conductivity in a multiple regression. In
8 addition, Ephemeroptera occur even when habitat is poor. The
9 weight of the scored body of evidence indicated habitat was
10 not a substantial confounder."

11 Q. Okay. So Suter and Cormier considered habitat as a
12 confounder and rejected it, right?

13 A. That's correct.

14 Q. And is that also what Bernhardt just did?

15 A. Correct.

16 Q. Different --

17 A. And Pond, yes.

18 Q. All different methods.

19 A. All different methods.

20 Q. All published in different journals.

21 A. Yes.

22 Q. All peer-reviewed journals.

23 A. Yes.

24 Q. All top-flight journals in their fields.

25 A. Yes.

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1 Q. Okay. Would you read the next sentence?

2 A. "No evidence supported embeddedness as a confounder."

3 Q. Okay. So, again, Suter and Cormier considered
4 specifically embeddedness and rejected it as a confounder,
5 right?

6 A. Correct.

7 Q. Okay. Would you turn again to JE 0096?

8 A. Yes.

9 Q. And do you see -- would you read the sentence in the
10 second column?

11 A. "The weight of evidence for confounding from ponds is
12 uniformly negative, so we conclude that the presence of ponds
13 has little or no effect on invertebrate response to
14 conductivity."

15 Q. Again, eliminating ponds as well as the other factors as
16 confounders, right?

17 A. Correct.

18 Q. Okay. The last one, the last Suter and Cormier, let's
19 skip that one and move on to the next Pond article, which is
20 Pond 2014 at page 1825.

21 A. Okay.

22 Q. What did Pond do in that study?

23 A. Here, Pond took a different approach. So he went to
24 headwater streams that had valley fills in them that had been
25 reclaimed previously, some reclaimed as long ago as 33 years

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1 prior to 2011, and then sampled -- also sampled local
2 reference streams that had no valley fills and then he
3 compared what he found in those two.

4 Q. Okay. And would you turn to PE 1835?

5 A. Okay.

6 Q. Would you read the sentence that begins with the numeral
7 3?

8 A. "Water quality is most likely the primary barrier to
9 recovery but proximity to clean sources (intervening tribs)
10 may include some sensitive taxa that increase the biological
11 indices used to measure condition."

12 Q. What does that mean?

13 A. Well, what it means is that water quality will cause
14 extirpation, but if you have a tributary that flows into a
15 stream with high conductivity but the tributary is healthy,
16 then you can get drifting organisms moving into that. So
17 you're sometimes going to get organisms you don't expect.

18 Q. So if you have one stream high in conductivity and
19 another stream that's low in conductivity beside one another,
20 you're likely to get drift of organisms into the high
21 conductivity stream.

22 A. That's correct. No question.

23 Q. Would you turn the page to 1836? And in the first
24 column, the second -- I think it's the second sentence
25 beginning "Habitat," do you see that?

Palmer - Direct

1 A. Yes.

2 Q. Would you read that, please?

3 A. "Habitat can be a limiting factor, but by design, we
4 removed significant habitat degradation factors by selecting
5 sample reaches with relatively good habitat and intact
6 riparian vegetation at reference and valley fill sites."

7 Q. So Pond here, in essence, did the same thing that the
8 benchmark and Bernhardt did and removed habitat as a
9 confounder.

10 A. Yes. He did it in a different way; by his experimental
11 design, removed it so that it wouldn't confound the results.

12 Q. Right. He didn't do the same statistical analysis that
13 EPA did. He gathered different data and went at it in a
14 different way.

15 A. Right. He didn't need to remove the effect through
16 statistical methods because he did it in his experimental
17 design.

18 Q. And would you read, on the second column there at the
19 bottom, beginning "Overall," to the end of the page?

20 A. "Overall, biological variation was strongly correlated
21 with water chemistry and less by reach-scale habitat and
22 landscape conditions. Since ion concentrations explained the
23 greatest amount of biological impacts and were the most
24 altered (compared to reference), this suggests that recovery
25 is potentially hindered by ions, even in forested regions long

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1 after reclamation."

2 Q. Just continue to the end, if you would.

3 A. "Causal analyses by Suter and Cormier (2013) provided
4 evidence that ions (measured as specific conductance)
5 negatively affected invertebrates despite other stressors
6 present."

7 Q. So Pond here finds that even in forested, reforested
8 ecosystems with high conductivity, you still have impairment.

9 A. That's correct.

10 Q. Okay. And then turn to the next page, please, and the
11 second passage there beginning "Cormier and Suter" -- or
12 "Cormier et al."

13 A. "Cormier et al. (2013b) and Suter and Cormier (2013)
14 provided strong causal evidence that Appalachian
15 macroinvertebrate extirpation is linked to increasing ions (as
16 specific conductance), a finding supported by our study."

17 Q. So here Pond is saying that his study supports the
18 benchmark and Suter and Cormier, right?

19 A. That's correct.

20 Q. And he uses a completely different method to do it.

21 A. Correct.

22 Q. Came to the same conclusion.

23 A. Yes, that conductivity caused impairment. Yes.

24 Q. Just like Bernhardt did.

25 A. Correct.

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1 Q. Let's turn to the next page, "Temporal changes in
2 taxonomic and functional diversity of fish assemblages
3 downstream from mountaintop mining," a Hitt article.

4 A. Yes.

5 MR. MCLUSKY: Your Honor, this is one we do object
6 about. The title of the article is "Temporal changes in
7 diversity of fish assemblages." She's rendered no opinion in
8 her opinion here, the report, about fish. And she said at her
9 deposition she would not be rendering one. So I'm not quite
10 sure what this is about.

11 THE COURT: All right.

12 MR. LOVETT: Actually, it's different. She's not --
13 well, first of all, I think her opinion does say that she has
14 an opinion about fish, but this isn't about fish. It's about
15 the method that Hitt used to determine that fish were
16 impacted; namely, that insects were missing.

17 So it really establishes that the aquatic insects are
18 missing --

19 THE COURT: Well, all right.

20 MR. LOVETT: -- and that affects fish.

21 THE COURT: I will allow it at least for that
22 limited purpose, but now we seem to have a debate about
23 whether in her report she disclosed opinions about impacts to
24 fish.

25 MR. LOVETT: We don't care about fish. We'll give

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1 up on the fish. We care about fish. Don't get me wrong. But
2 for this case, this is not about fish.

3 THE COURT: All right.

4 BY MR. LOVETT:

5 Q. Okay. Would you read on page 129 beginning, "The
6 transition from reference to exposure fish assemblage." Do
7 you see that?

8 A. Yes.

9 Q. Read to the end of that.

10 A. "The transition from reference to exposure fish
11 assemblage composition occurred at conductivities between
12 about 600 and 1000 microsiemens per centimeter (Figure 2A).
13 These values exceed conductivity levels expected to reduce
14 benthic macroinvertebrate diversity in Appalachian streams.
15 USEPA (2011a) identified a protective benchmark for benthic
16 macroinvertebrate assemblages at 300 microsiemens per
17 centimeter, and our results suggest that the thresholds for
18 fishes will be somewhat higher."

19 Q. Read on.

20 A. "Decreases in abundances of obligate invertivores at TE
21 suggest that changes in fish assemblages might be a
22 consequence of decreased availability of invertebrate
23 prey."

24 Q. And the invertebrate prey are insects. Is that what
25 that's determining?

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1 A. Invertebrate prey are insects. Invertivores are
2 organisms that eat insects.

3 Q. So Hitt et al. are also noting the loss of insects from
4 the streams.

5 A. That's correct.

6 Q. And let's turn to the next one, JE 0133.

7 A. Yes.

8 Q. That's a Kennedy paper?

9 A. Yes.

10 Q. Would you read in the abstract, about halfway down, the
11 sentence beginning, "In the Leading Creek Watershed."

12 A. "In the Leading Creek Watershed (southeast Ohio), an
13 aggregated approximately 99 percent reduction in mean mayfly
14 abundance for all impacted sites was observed below a coal-
15 mine effluent with mean specific conductance of 8,109."

16 Q. Okay.

17 A. Continue?

18 Q. Yeah, continue, please.

19 A. "The mayfly, *Isonychia*, was exposed for 7 days to a
20 simulation of this effluent, in lotic microcosms. Based on
21 lowest observable adverse effect concentrations, *Isonychia*
22 survival was a more sensitive endpoint to specific conductance
23 (1,562 microsiemens) than were 7-day *C. dubia* survival and
24 fecundity (3,730 microsiemens)."

25 Q. So *Isonychia* is a mayfly, right?

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1 A. It is.

2 Q. It's a very tolerant -- it's a mayfly that's very
3 tolerant to conductivity, right?

4 A. It is.

5 Q. And how do we know that?

6 A. Well, it's one of the mayflies that the benchmark
7 developed an XC95 for.

8 Q. Do you remember what XC95 the benchmark developed for
9 that mayfly? If you don't --

10 A. Is it 1092? I'm not positive. I'd have to go back and
11 look.

12 Q. We'll do that in the next paper.

13 Okay. But in any event, that sensitive mayfly in a lab
14 when exposed to water, the conductivity is at 1562? Is that
15 the level at which the mayfly died in a lab?

16 A. That was what they found, yes, the lowest concentration.

17 Q. So that very sensitive -- or very insensitive mayfly was
18 killed when water reached 1062 conductivity in a lab -- or,
19 excuse me -- 1562 in a lab?

20 A. Well, the lowest observable adverse effect
21 concentrations.

22 Q. Okay.

23 A. And I'd have to look at the paper because I can't
24 remember if they looked at mortality as well as reproduction.
25 They may have had multiple end points.

Palmer - Direct

1 Q. Okay. Let's turn to the Kuntz paper, which is the next
2 one.

3 And the Kuntz paper also -- what did it do?

4 A. So this is another example where organisms are exposed to
5 mixtures with different ionic strengths to toxicity testing in
6 a seven-day toxicity testing. And they did this with both
7 *Ceriodaphnia*, which is a cladoceran, a crustacean, and they
8 did it with a mayfly, *Centroptilum triangulifer*.

9 And do you want me to go on?

10 Q. Yes.

11 A. And they used water -- the ionic composition that they
12 put together to expose them to was representative of what you
13 find in alkaline mine drainage areas associated with
14 mountaintop removal and valley fills. And they also used a
15 different reconstituted water that was more representative,
16 neutralized mine drainage. And the waters that had similar
17 conductivities but with different ionic compositions, they had
18 different effects on the organisms, but they were consistently
19 toxic. And that was true for mussels, anthropods, and
20 mayflies.

21 Q. Okay. At what level -- let's turn to JE 0160.

22 And do you see that where it says, "The Winding Shoals
23 and Boardtree reconstituted waters"?

24 A. Yes.

25 Q. So did Kuntz actually use water from Boardtree, or do you

Palmer - Direct

1 understand what he did here?

2 What is reconstituted water?

3 A. I don't remember if the water came directly from
4 Boardtree or if he established the mixture of ions that was
5 almost identical to what was in Boardtree. I'd have to look
6 back.

7 Q. Okay. In any event, he subjected *C.* -- is it *triang* --
8 how do you say that?

9 A. *Triangulifer*.

10 Q. Okay. What is that?

11 A. It's a mayfly.

12 Q. And it's a relatively tolerant mayfly, tolerant to high
13 conductivity, right?

14 A. It is. It's not that different from *Isonychia*.

15 Q. Okay. We know -- so would you read that passage there
16 beginning, "The Winding Shoals"?

17 A. "The Winding Shoals and Boardtree reconstituted waters
18 were toxic to *C. triangulifer* at a conductivity of about 800
19 to 1300 microsiemens with elevated concentrations of
20 magnesium, calcium, sodium, potassium, sulfate, or
21 bicarbonate. It is interesting to note that the regional
22 95 percent extirpation concentration based on conductivity for
23 the genus *Centroptilum*," which is the *triangulifer*, "in the
24 benthic community field surveys was determined to be 1092."

25 So there's that number I remember.

Palmer - Direct

1 Q. So 1092 is what the benchmark found for that particular
2 organisms to be the extirpation point?

3 A. Yeah. I'm assuming reference 35 is to the benchmark.

4 Q. Okay. Here, let's make sure we have it right.

5 May I approach, Your Honor?

6 THE COURT: You may.

7 BY MR. LOVETT:

8 Q. So, Dr. Palmer, do you have the benchmark before you now?

9 A. I do.

10 Q. And are you looking at a page that has the numbers for --
11 well, what does it have?

12 A. Well, I see a number for Isonychia, the one I couldn't
13 remember, which is 1180 microsiemens is the extirpation.

14 Q. 1180. And Kennedy in his labs showed 1562.

15 A. That's correct.

16 Q. Okay. So -- and here we have -- do you see the *C.* -- the
17 one we're talking about now, *C. triangulifer*?

18 A. I don't see it on this page, but I'll look more. I'm
19 sure it's here.

20 Q. 1092 is the number.

21 May I approach, Your Honor?

22 THE COURT: Yes.

23 BY MR. LOVETT:

24 Q. So --

25 (Mr. Lovett and Mr. Hecker conferred privately off the

Palmer - Direct

1 record.)

2 BY MR. LOVETT:

3 Q. On page D3 of the benchmark is the first one.

4 A. There it is. *Centroptilum* is a Baetidae fly and it has
5 an extirpation concentration of 1092 microsiemens.

6 Q. So the benchmark found, through its science and analysis
7 of the DEP database, that 1092 was the number for that
8 organism, right?

9 A. Correct.

10 Q. And Kuntz found that it's between 800 and 1300 in a
11 laboratory.

12 A. That's correct.

13 Q. So they essentially -- Kuntz essentially corroborates the
14 benchmark's field data through lab tests; is that right?

15 A. That's correct. And as I recall, Kuntz may have had
16 different instars. So you would expect to get a range if you
17 have early and late instars.

18 Q. Okay. So we have several lines of evidence now all
19 reaching the same conclusion, right?

20 A. That's correct.

21 Q. Starting with the EIS way back in 2003 and proceeding all
22 the way to these lab tests in 2014?

23 A. That's correct.

24 Q. With different methods from field data to EPA -- or to
25 DEP data analyzed by EPA, to DEP analyzed -- data analyzed a

Palmer - Direct

1 different way by Bernhardt, all reaching the same conclusion,
2 aren't they?

3 A. That's correct. There's field data. There's lab data.
4 There's field observational data. There's field experimental
5 data. There's toxicity testing. So, yes, lots of different
6 lines of evidence.

7 Q. And there's not a single peer-reviewed study to the
8 contrary, is there?

9 A. I know of none.

10 Q. Okay. When you see a publication history like this one,
11 do you -- I mean, is this -- does this show you as an expert
12 in your field that the evidence is in that conductivity is
13 causing impairment below valley fills?

14 A. I would say there's no doubt. What surprised me is that
15 the studies continue to go on. I can only assume that's
16 because there's controversy, because it's been so well-
17 established.

18 Q. Have you reviewed -- let's shift gears here now and turn
19 to the mines at issue in this case.

20 Have you reviewed the data and maps associated with the
21 mines and waters at issue in the instant case?

22 A. I have.

23 Q. Okay. And have you reached an opinion based on the
24 review of those data and information?

25 A. I have.

Palmer - Direct

1 Q. And do you believe that each of the three -- well, what's
2 your opinion about each of the three mines?

3 A. Well, it's very clear that in all -- for all three of the
4 mines, that there's elevated conductivity that's occurred
5 since the mines -- the Fola Mines have been put in and that
6 this is associated with extirpation or loss of taxa.

7 Q. And impairment under the WVSCI?

8 A. Impairment, yes.

9 Q. Okay. Do you believe that the ionic mixture in the water
10 discharged from each of the three mines is causing biological
11 impairment in the streams that are downstream from those
12 discharges in the three tributaries of Leatherwood Creek?

13 A. Yes.

14 Q. And do you use -- did you use information and data to
15 prepare the figures and tables in your expert report?

16 A. I did.

17 Q. And we'll go through those now.

18 A. Okay.

19 Q. All right. Let's start with Plaintiffs' Exhibit 34.

20 A. Okay.

21 Q. Okay. Is that figure 1 a topographic map of the Fola
22 Surface Mines 4A, 2, 6?

23 A. It is.

24 Q. In Leatherwood Creek?

25 A. Leatherwood Creek, three mines.

Palmer - Direct

1 Q. So Fola 4A is on the left-hand side of the page, correct?

2 A. Correct.

3 Q. And that's Right Fork? Explain the streams there, if you
4 would.

5 A. Fola 4A, which is the furthest to the west --

6 Q. Okay.

7 A. -- is Right Fork. Fola 2, which is sort of in the middle
8 there, is Road Fork. And these are tributaries to
9 Leatherwood.

10 And Fola 6 is Cogar Hollow, which is also a tributary to
11 Leatherwood. And the sort of white squiggly above the -- on
12 the page above those three mines is Leatherwood.

13 Q. So each of these -- so Right Fork -- I mean, excuse me --
14 Fola 4A has a tributary to Leatherwood called Right Fork.

15 A. Correct.

16 Q. And Fola 2 has a tributary to Leatherwood Creek called
17 Road Fork.

18 A. Yes.

19 Q. Fola 6 has Cogar Hollow tributary.

20 A. Right.

21 Q. And Road Fork is the white squiggly through the middle of
22 the page.

23 A. Right, slightly top middle, yes.

24 Q. Okay. Do you know what percentage of the Road Fork and
25 Right Fork watersheds are disturbed by Mines 2 and 4A?

Palmer - Direct

1 A. I think overall in Leatherwood, it's, like, 40. But in a
2 couple of them, it's up to 80 percent has been disturbed by
3 mining. So it's probably 4A and 2.

4 Q. You don't remember? That's okay.

5 A. Sorry. I don't remember which go with which, but I think
6 that's right.

7 Q. In any event, you remember that two of them have
8 80 percent and one of them has 40 percent.

9 A. I think the overall watershed was 40 percent, but that's
10 my recollection.

11 Q. Okay.

12 A. Bottom line is there's a lot of mining and it's the
13 dominant land change.

14 Q. Let's turn to Joint Exhibit 20. That's a different book.

15 A. Okay.

16 Q. And what is that?

17 A. This is the 2012 Final West Virginia Integrated Water
18 Quality Monitoring and Assessment Report.

19 Q. Okay. Would you --

20 THE COURT: Excuse me. I don't think I have a set
21 of the joint exhibit notebooks. I've had my own copy of the
22 benchmark. I've got volumes, let's see -- three notebooks
23 titled Defendant's Exhibits, these three, and then --

24 MR. LOVETT: It says Judge's Copy on it, so it must
25 be yours.

Palmer - Direct

1 THE COURT: Okay.

2 MR. LOVETT: Sorry about that.

3 THE COURT: That's all right.

4 THE CLERK: Judge, there should be a law clerk copy
5 as well.

6 MR. LOVETT: Let's give this to the judge. I'll
7 give you mine.

8 THE CLERK: And there should be a third for the law
9 clerk.

10 THE COURT: Do you have another copy?

11 MR. LOVETT: Do we have another copy?

12 I have a copy I'm using, Your Honor. Your Honor, the one
13 Dr. Palmer has will be the clerk's copy.

14 Is that okay if she uses it and give it to you after
15 that?

16 THE COURT: Fine.

17 THE CLERK: Are you giving me all of the exhibits as
18 originals on a disk, then?

19 MR. BECHER: Yes.

20 THE WITNESS: So what was the number again you asked
21 me to turn to?

22 MR. LOVETT: 20.

23 THE WITNESS: Okay. Yes, I've got it.

24 BY MR. LOVETT:

25 Q. Let's turn to pages 10 and 11 of that, or 1067 and 1068.

Palmer - Direct

1 It's the 303(d) list.

2 A. Pages 10 and 11 of --

3 Q. 10 and 11 --

4 A. The report numbers?

5 Q. -- of the actual documents or --

6 (Mr. Hecker and Mr. Lovett conferred privately off the
7 record.)

8 BY MR. LOVETT:

9 Q. It says List Page 10. It's page 10.

10 A. Okay. Of the West Virginia document --

11 Q. Yes.

12 A. -- not page 10 of the exhibit?

13 Q. It's page 10 of the document. It says at the top "2012
14 Section 303(d) List."

15 (Mr. Lovett and Mr. McLusky conferred privately off the
16 record.)

17 THE WITNESS: That's not what I have.

18 Did you find it?

19 THE COURT: This is upside down, but this is what I
20 got. (Indicating)

21 THE WITNESS: Right, but he said at the top --

22 MR. LOVETT: Bob is telling me if you go on -- I
23 don't think those are numbered.

24 Do you have Bates numbers on --

25 THE WITNESS: No, there aren't exhibit numbers.

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1 THE COURT: There's the original document page
2 number at the bottom, page 10 of the original document.

3 MR. LOVETT: Yes, it's page 10 of the original
4 document.

5 THE WITNESS: I've got that.

6 MR. LOVETT: Well, except this is confusing, and I
7 don't know how these exhibits were made, so I apologize. But
8 if you turn to the back of the document, I think there's an
9 appendix or some appendices, and it's page 10 of one of those.

10 THE COURT: Which appendix?

11 MR. LOVETT: It says --

12 THE WITNESS: 303(d) list?

13 MR. LOVETT: Yes. It says List Page 10. Do you see
14 that at the bottom?

15 THE WITNESS: Yes, I do. At the top of the page, it
16 says "2012 Section 303(d) List."

17 MR. LOVETT: Okay. All I can say, Your Honor, is I
18 apologize. Plaintiffs did not prepare these notebooks.

19 BY MR. LOVETT:

20 Q. Page 10, List Page 10, 2012 303(d) List, right?

21 A. Yes.

22 Q. And there it has Elk Watershed - Huc#05050007 at the
23 bottom?

24 A. Yes. Elk Watershed, yes.

25 Q. Do you see Leatherwood Creek listed there?

Palmer - Direct

1 A. I see Right Fork/Leatherwood Creek.

2 Q. Well, there's Leatherwood Creek right above that, right?

3 A. There's Leatherwood above that and then there's Right
4 Fork -- yes.

5 Q. Okay. So Leatherwood itself, that's the main stem?

6 A. That's correct, that would be the main stem.

7 Q. And is it listed as impaired? It is because it's on this
8 list, right?

9 A. It's on the 303(d) list, correct.

10 Q. And does it --

11 A. The entire length it says.

12 Q. And for what criterion?

13 A. For biological criterion.

14 Q. Okay. Caused by?

15 A. Mining.

16 Q. Okay. Just out of curiosity, I mean, if you look at
17 Bullpen Fork or Sutton Lake above, they're both also impaired,
18 right?

19 A. They are.

20 Q. And Bullpen is impaired for selenium, right?

21 A. It is.

22 Q. So the DEP knows how to determine if something is
23 impaired for biological impairment or for selenium, because
24 they're distinct, right?

25 A. That would appear so, yes.

Palmer - Direct

1 Q. Okay. Leatherwood is impaired for biological reasons.

2 A. Correct.

3 Q. Okay. And is that also true of the Right Fork of
4 Leatherwood Creek?

5 A. Yes, it's impaired for biological. The source is mining.

6 Q. And would you turn the page, please, to this page 11?

7 A. Okay.

8 Q. And do you see Road Fork?

9 A. I do.

10 Q. And is it also impaired?

11 A. It is impaired biologically. Source is mining.

12 THE COURT: What does "CNA" mean? Do you know? It
13 says "CNA - Biological."

14 THE WITNESS: I don't --

15 BY MR. LOVETT:

16 Q. Do you know?

17 A. I don't recall.

18 MR. MCLUSKY: Conditions Not Allowable.

19 MR. LOVETT: Conditions Not Allowable. Thank you.

20 BY MR. LOVETT:

21 Q. Now, let's turn to Joint Exhibit 16. I hope this works.
22 I hope that the exhibits -- and that should be EPA Approved
23 Report for TMDLs for May 2012.

24 Do you see that?

25 A. Is it in this same volume? No.

Palmer - Direct

1 Q. It should be.

2 A. Oh. 60 or 16?

3 Q. 16, one-six.

4 A. No, it's not in this.

5 Q. Joint Exhibit 16.

6 A. This is Volume 1.

7 All right. I've got it.

8 Q. Is it U. S. -- does it -- is it called May 2012 TMDL
9 Report?

10 A. May 2012 Total Maximum Daily Loads for Selected Streams
11 in the Elk River Watershed.

12 Q. Okay. I hope this is right. Will you turn -- does that
13 have Bates numbers on it, you know, like JE numbers at the
14 bottom?

15 A. No.

16 Q. It does not? Okay.

17 Would you turn to page 24 of the Elk River Watershed TMDL
18 Report? Do you see that?

19 A. The first paragraph starts "In certain waters"?

20 Q. Yes. Good.

21 A. Got it.

22 Q. Would you read about the first third of that paragraph?

23 A. "In certain waters (Leatherwood Creek" -- I'm not going
24 to read all the letters. Is that okay?

25 Q. That's fine.

Palmer - Direct

1 A. Okay. "Leatherwood Creek, Right Fork/Leatherwood Creek,
2 Road Fork/Leatherwood Creek, Big Branch, Birch River, and
3 Jacks Run) the SI process determined ionic toxicity to be a
4 significant stressor. A strong presence of sulfates and other
5 dissolved solids exists in those waters and in all other
6 streams where ionic toxicity has been determined to be a
7 significant biological stressor."

8 Q. That's sufficient. And so this is prepared for the
9 West Virginia DEP, right?

10 A. That's my understanding, yes.

11 Q. And this report found itself that these streams are
12 impaired for -- because of ionic stress. And that's what you
13 just read, right?

14 A. It says it determined it to be a significant stressor.
15 In what I just read, I don't see it mentioning -- well, yes,
16 it does. I'm sorry. "To be a significant biological
17 stressor." It does end in that.

18 Q. This also says, "A strong presence of sulfates and other
19 dissolved solids exists in those waters and in all other
20 streams where toxicity has been determined to be a significant
21 biological stressor," right?

22 A. That's correct.

23 Q. Okay. Let's now look at data for the mines individually
24 and start with Mine No. 2 at Road Fork. And, I'm sorry, but
25 would you get the plaintiffs' exhibit book?

Palmer - Direct

1 A. Okay. What number?

2 Q. Let's turn to Plaintiffs' 35. That's the map again.

3 A. Okay. I'm already there.

4 Q. Okay. And this is the same map that we saw before,
5 right?

6 A. Yes, it is.

7 Q. And does it show the location of the No. 2 Mine?

8 A. Yes, Fola 2, right in the middle.

9 Q. And you've showed us already where Road Fork is, right?

10 A. Correct, that it's in the middle.

11 Q. And then the next -- let's turn to 36.

12 And does that depict the valley fills -- well, what does
13 it depict?

14 A. This is a sort of close-up view of Road Fork. And just
15 above the yellow sort of polygon towards the bottom of the
16 page, you see the valley fills, which are double blue lines in
17 triangular shapes, and there are three valley fills.

18 Q. Okay. And can you show us where -- well, it's hard to do
19 with the judge -- hold that up so the judge can see it.

20 THE COURT: I can see it.

21 BY MR. LOVETT:

22 Q. Would you point to where the outlets are to the valley
23 fills?

24 A. And there is an outlet here and over on the red triangle.

25 (Indicating)

Palmer - Direct

1 THE COURT: All right.

2 THE WITNESS: And further down, there's another one,
3 007. (Indicating)

4 THE COURT: All right.

5 BY MR. LOVETT:

6 Q. Are those all the outlets, then?

7 A. Yes. Outlet 1 is the red triangle at the left corner,
8 and -- yeah.

9 Q. All below valley fills, right?

10 A. Yes.

11 Q. Is there --

12 A. I think that outfall is from that pond there that --
13 where the valley fills all empty into that.

14 Q. Is there any other development activity than mining in
15 the Road Fork watershed?

16 A. No, there's not.

17 Q. Okay. Let's turn to Plaintiffs' Exhibit 118,
18 one-one-eight.

19 A. Okay.

20 Q. Is this the CHIA for the mine?

21 A. It is.

22 Q. And what is a CHIA, if you know?

23 A. It's the hydrologic impact assessment.

24 Q. Prepared by the DEP?

25 A. That's correct.

Palmer - Direct

1 Q. Okay. Would you look at pages 1209 and 1210?

2 A. Okay.

3 Q. And would you read at the bottom of 1209 where it says,
4 "Road Fork does not."

5 A. "Road Fork does not appear heavily impacted by extensive
6 past mining which has occurred in this area. This is
7 indicated by low metals and sulfates that are less than
8 30 milligrams per liter."

9 Q. Okay. So when DEP prepared this report before mining
10 began, that was its conclusion, right? Is that right?

11 A. That is correct.

12 Q. And that's from 1994?

13 A. This is related to, I believe, the application for the
14 Fola Surface Mine 2.

15 Q. Right.

16 A. So it will be prior to the mining, yes.

17 Q. This SMCRA permit?

18 A. Exactly, I guess --

19 Q. If you turn the page, I think you'll see it was prepared
20 in 1994.

21 Do you see that? It's the last page there.

22 A. Yes. June 28, 1994.

23 Q. Let's turn to Plaintiffs' Exhibit 37.

24 A. Okay.

25 Q. And that is figure 4, right?

Palmer - Direct

1 A. That's correct, figure 4 from my report.

2 Q. Did you prepare that?

3 A. I did.

4 Q. And did you do it after reviewing data comparing the
5 levels of conductivity and sulfate in Road Fork before and
6 after mining?

7 A. That's correct. That was the purpose of this, these
8 graphs, to show the data.

9 Q. Okay. All right. So explain to me or the Court what the
10 graphs and the data show.

11 A. Well, the most relevant ones are the top two that have
12 red lines and dots.

13 Q. Okay.

14 A. And if you notice the dashed line, horizontal line, near
15 the bottom of those two panels --

16 Q. Uh-huh.

17 A. -- that is the conductivity benchmark level. So on the
18 horizontal axis is date, and the vertical axis is
19 conductivity. And what you see is that over time, prior to
20 mining at Road Fork, the conductivity every time it was
21 measured was well below the benchmark of 300 microsiemens.

22 Q. Right.

23 A. And then post mining, what you see is, with the exception
24 of perhaps looks like two sampling times, the conductivity was
25 significantly elevated above the benchmark. It looks like it

Palmer - Direct

1 reaches levels, at least at one point in time, of over 5000
2 microsiemens.

3 Q. 5000. Okay.

4 A. Yes.

5 Q. And sulfates -- the next two panels are similar, right?

6 A. Yes. You would expect that because sulfate is one of the
7 major contributing ions to conductivity, and so it follows the
8 same sort of pattern.

9 Q. Let's next turn to Plaintiffs' Exhibit 38.

10 Again, have you reviewed data showing the ionic mixture
11 of the post mining discharges from Outlet 001 at Mine 2?

12 A. Yes. The pH was 8.28 from that outlet, and the
13 conductivity was 3290 microsiemens, with a sulfate level of
14 over 400.

15 Q. Okay. So those are -- did you prepare table 1?

16 A. Yes.

17 Q. Okay. And these are -- are these all post mining?

18 A. That's correct.

19 Q. Okay. So at Road Fork, conductivity 3290; Boardtree,
20 2367; and Road Fork, again 2710 conductivity?

21 A. Uh-huh.

22 Q. Okay. How does that mixture compare to alkaline mine
23 drainage associated with streams affected by mountaintop
24 mining and valley fills in Central Appalachia?

25 A. It's very comparable, and that's the reason that the

Palmer - Direct

1 Boardtree Branch example was put in there. It's a different
2 stream. It's not in this mix. And yet if you notice, the
3 same constituents are elevated; conductivity, hardness,
4 sulfate, etcetera, calcium, magnesium.

5 Q. And how does that -- if you look at the Boardtree Branch,
6 out of curiosity, how does that -- that's the very water that
7 Kuntz was studying in the --

8 A. That's correct.

9 Q. -- in the paper.

10 A. It's the one that he used to come up with the
11 reconstituted water that he exposed organisms to.

12 Q. And did he come up with the number 1090 in the lab? Is
13 that what it was?

14 A. I think that's correct.

15 Q. And what is the number here for Boardtree Branch?

16 A. The number here is -- the conductivity --

17 Q. Yes.

18 A. -- is 2367.

19 Q. Much higher than Kuntz found would basically kill the
20 tolerant mayfly.

21 A. Correct. Yes.

22 Q. Turn to Plaintiffs' Exhibit 39.

23 Now, did you prepare this?

24 A. Yes.

25 Q. And does it summarize data showing a level of

Palmer - Direct

1 conductivity discharge from Outlets 001 in 2011 and '12?

2 A. That's correct.

3 Q. Okay. What do those data show about the conductivity
4 level during that time?

5 A. Well, so these more recent times, it simply shows that
6 the conductivity has remained elevated, so, again, up to above
7 4000 microsiemens at least at one point in time, but always
8 well above the benchmark.

9 Q. And almost always above 2000?

10 A. Yes, almost always above 2000. Pretty much 3000 would be
11 the most common.

12 Q. Okay. Let's turn to Plaintiffs' Exhibit 40.

13 Did you prepare these?

14 A. I did.

15 Q. And did you prepare them by looking at WVSCI scores for
16 Road Fork from Outlets 001?

17 A. Yes. It shows what is happening in the stream downstream
18 and upstream of the outlet.

19 Q. And explain what's happening.

20 A. Actually, I misspoke. It shows what's happening
21 downstream of the outlet. That would be the X. And then it
22 shows what happens in Leatherwood before upstream and
23 downstream of when the water from Road Fork enters
24 Leatherwood.

25 And so it shows you that basically in the outlet, you

Palmer - Direct

1 have failing WVSCI scores as you do as well in Leatherwood.

2 MR. LOVETT: Your Honor, all of these data are in
3 Plaintiffs' Exhibit 73, which is a stipulation by the parties.
4 I don't think there will be any controversy about the data.

5 THE COURT: All right.

6 MR. LOVETT: I'm not going to take you to the
7 stipulation every time --

8 THE COURT: That's fine.

9 MR. LOVETT: I just want you to be aware.

10 THE COURT: We'll need to take a break at some point
11 when it's convenient.

12 MR. LOVETT: This is a fine time, Your Honor.

13 THE COURT: All right. We'll take a ten-minute
14 recess.

15 (Recess from 2:47 p.m. to 2:57 p.m.)

16 BY MR. LOVETT:

17 Q. Okay. Dr. Palmer, you were looking at Exhibit 40, page
18 119, right?

19 A. Yes.

20 Q. Okay. Do those data indicate biological impairment in
21 Road Fork downstream from Outlet 001?

22 A. Yes, they do show that.

23 Q. Were conductivity, sulfate, and RBP, or rapid
24 bioassessment protocol, also measured when the WVSCI scores
25 were measured?

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1 A. That's correct. And the conductivity scores are up to, I
2 don't know, 3200 or something.

3 Q. In your opinion, would the rapid bioassessment protocol
4 scores cause those low WVSCI scores?

5 A. No, they could not. The RBP scores are anywhere from
6 perhaps 110 to 130 or something like that, which is
7 suboptimal, but it's not marginal.

8 Q. So if I recall, the levels are optimal, suboptimal,
9 marginal, and poor.

10 A. That's correct.

11 Q. So suboptimal is like a B.

12 A. Yes, I guess.

13 Q. Okay. So we have habitat like that in these tables,
14 right?

15 A. That's correct.

16 Q. In your opinion, that could not cause the impairment.

17 A. Not what we're seeing here, no.

18 Q. Just tell me briefly why you think that, in your
19 experience.

20 A. Well, I actually have done extensive work myself showing
21 that if there are water chemistry problems, it doesn't matter
22 typically how good the habitat is; the factor that will trump
23 all other things is going to be that chemistry.

24 Q. Okay. Turn to Exhibit -- Plaintiffs' Exhibit 25.

25 A. Okay.

Palmer - Direct

1 Q. Now, these are WVSCI scores taken recently by Dr. Swan, a
2 plaintiffs' witness that will probably be next, correct?

3 A. That's correct.

4 Q. Okay. And did you prepare this table?

5 A. I believe he prepared the table and then I put it in my
6 report as an appendix.

7 Q. I see. Okay. Did Dr. Swan -- what did Dr. Swan find to
8 be the WVSCI score when he sampled Road Fork in May of 2014?

9 A. The WVSCI score was -- let me find it -- 39.66, impaired.

10 Q. Okay. And he did a GLIMPSS score too, right?

11 A. He did. 20.22.

12 Q. Okay. Just out of curiosity, what is the GLIMPSS cutoff
13 for impairment?

14 A. I think it's 52.

15 Q. And did he also do an RBP?

16 A. I'm sure he did, yes.

17 Q. Okay. That's not on this exhibit, is it?

18 Let's turn to Plaintiffs' Exhibit 31. Is that a rapid
19 bioassessment protocol performed by Dr. Swan at Road Fork?

20 A. Yes, it is.

21 Q. And what date is on it?

22 A. May 9th, 2014.

23 Q. And what score did he come up with for the habitat?

24 A. He did not sum his scores on his RBP sheets, but I summed
25 them up, and I believe this one was 170.

Palmer - Direct

1 Q. One-seven-zero?

2 A. I believe so.

3 Q. And what --

4 A. I'd have to look back at my report to verify, but I'm
5 pretty sure that's right.

6 Q. And is 170 suboptimal or optimal?

7 A. It's suboptimal, but it's in the high end of suboptimal.

8 Q. Okay. Could those RBP scores cause the low WVSCI score
9 that you found there?

10 A. No, no, not possibly.

11 Q. Why not?

12 A. Well, the scores are not bad at all. So there's many,
13 many streams you find that don't have what is considered the
14 ideal habitat that have very healthy invertebrates.

15 Q. I think to be sure that -- you can retotal if you'd like,
16 but I think the total is 163.

17 A. I believe you.

18 Q. Okay. Does that change your opinion?

19 A. No.

20 Q. Okay. Let's turn back to Exhibit 25.

21 Did Dr. Swan find any mayflies in Road Fork?

22 A. No. I know he didn't. I remember that.

23 Q. None, right?

24 A. No mayflies, zero.

25 Q. Now, let's turn to 4A, Fola 4A, the second of the three.

Palmer - Direct

1 Let me do one thing before we do that. I got mixed up
2 with exhibits for a minute there and I -- at the break, I took
3 the opportunity to find the part of the benchmark that I
4 wanted you to read that I couldn't find before.

5 Would you turn to Plaintiffs' Exhibit 128? It should be
6 in the same notebook, I think. One-two-eight.

7 A. Okay.

8 Q. And is that the benchmark?

9 A. Yes.

10 Q. And would you turn to Bates page 1449.

11 I'm sorry. It's the SAB letter, not the benchmark.

12 Look to make sure that's right.

13 A. It is, yeah. I was thinking maybe it was behind that,
14 but, yes, it is the SAB.

15 Q. Okay. And does that page begin "Addressing Confounding
16 Factors"?

17 A. This page? Yes, it says, "Addressing Confounding
18 Factors."

19 Q. Would you read the paragraph -- the second paragraph that
20 begins, "The Panel commends."

21 A. "The Panel commends the authors for carefully considering
22 factors that may confound the relationship between
23 conductivity and extirpation of invertebrate genera. This is
24 accomplished by: (1) removing some potentially confounding
25 factors from the data set before determining the benchmark

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1 concentrations; and (2) considering weight-of-evidence of a
2 suite of other potentially confounding factors that were not
3 excluded from the data set - using correlations between
4 potential confounding factors, conductivity, and aquatic
5 genera (mayflies). The report has done a credible job in
6 isolating the major, potential confounding factors and
7 providing a basis for their assessment relative to the
8 potential effect associated with conductivity."

9 Q. And the Scientific Advisory Board is made up of very
10 eminent stream ecologists, among others, right?

11 A. It is, absolutely.

12 Q. Would you read the following sentence too, please?

13 A. What page?

14 Q. 14 -- 1449.

15 A. Okay.

16 Q. "The use of mayflies."

17 A. "The use of mayflies as the aquatic response variable in
18 the analyses of confounding factors was appropriate. It would
19 be helpful to reiterate in Appendix B" --

20 Q. That's enough.

21 All right. Let's move on to Fola 4A, the Road Fork --
22 the Right Fork, okay?

23 A. Uh-huh.

24 Q. And let's turn to Plaintiffs' Exhibit 42.

25 A. Okay.

Palmer - Direct

1 Q. And, again, this is the map, right?

2 Would you show the Court -- does the map show the
3 location of Fola 4A?

4 A. Yes. This is a map just of 4A.

5 Q. Could you point out where Outlets 022, 023, and 027 are,
6 just to the Court?

7 A. Yes. So Outlet 022 is the small red -- it's probably a
8 triangle, on the left side, which is the main stem of the
9 Right Fork trib.

10 THE COURT: 022?

11 THE WITNESS: That's 022 over here. And then to the
12 right of that is 023, which drains Rocklick Fork, which is a
13 trib that comes into Right Fork, and then --

14 THE COURT: Is that 009 and 023?

15 THE WITNESS: I guess it is. We've always --

16 THE COURT: One of those outlets that has duplicate
17 numbers?

18 THE WITNESS: Duplicate names. And then 027 is on
19 Cannel Coal tributary, which is above that. Again, it's the
20 red dot. So it's another major trib.

21 THE COURT: All right.

22 MR. LOVETT: Let me warn the Court that this mine is
23 the most complicated of the three. The other two are pretty
24 simple. And this will take a little longer and I'm afraid be
25 a little more confusing, but we'll try to get through it as

Palmer - Direct

1 quickly as we can.

2 BY MR. LOVETT:

3 Q. Let's look at Plaintiffs' Exhibit 43, and there's figure
4 9. There are monitoring points downstream from the discharge
5 points, right?

6 A. That's correct. Those are monitoring points.

7 Q. Would you show the Court where the three monitoring
8 points are at P-11, P-10, and P-9?

9 A. So the monitoring point P-9 is furthest at the bottom of
10 the page, and it's in the orange diamond, and it's sort of
11 right where Cannel Coal tributary comes into the main stem of
12 Right Fork.

13 Further downstream on the main stream -- main stem is
14 P-10, which is the second orange triangle, and that's on the
15 main stem of Right Fork clearly after Cannel Coal comes in.

16 And then almost towards the confluence with Leatherwood
17 is P-11, which is that orange triangle towards sort of the --
18 almost the top of the figure.

19 Q. And --

20 A. But it's still on the main stem of Right Fork.

21 Q. These are pre-mining monitoring points; is that right?

22 A. I believe so.

23 Q. Okay. Let's turn to Plaintiffs' Exhibit 89.

24 It should be the CHIA for this mine. Do you have that?

25 A. Yes, it is, Surface Mine 4A.

Palmer - Direct

1 Q. Let's turn to page 562, PE 0562. Do you see that?

2 A. I do.

3 Q. Okay. Let me move a little forward. Go to page -- I'm
4 sorry -- PE 0574, or 16 of the CHIA itself.

5 A. Okay.

6 Q. Do you see where it says "Right Fork of Leatherwood
7 Creek" down at the bottom?

8 A. Yes.

9 Q. And will you read where it begins, "The two sites"?

10 A. "The two sites on the upper reaches of the Fork, before
11 its confluence with Rocklick, show low buffered stream with
12 low metals and low sulfates, indicative of no previous mining
13 impact in the watershed in its upper reaches. The other two
14 sites are further downstream after mined tributaries enter the
15 stream."

16 Q. Let's continue to the end of the next sentence, "The
17 analyses shows."

18 A. "The analysis shows that the manganese and sulfates are
19 elevated from previous mining."

20 Q. Okay. So that's what DEP said about that site before
21 mining, right, in the CHIA?

22 A. That's correct.

23 Q. Now, let's look at the same exhibit, pages 577 and 578,
24 or page 19 of the CHIA. At the bottom it says, "In general,
25 all stations."

Palmer - Direct

1 A. "In general, all stations provide adequate habitat and
2 contain populations of benthic macroinvertebrates. All the
3 stations have high EPT indices."

4 Q. Okay. Would you read the sentence before that beginning
5 "The habitat assessment scores from those sites"?

6 A. "The habitat assessment scores from these sites ranged
7 from 117 to 160."

8 Q. Okay. And remind me, if you would again, what -- these
9 are suboptimal and optimal scores?

10 A. They're suboptimal.

11 Q. All right. So, again, that's the state of the streams
12 pre-mining, right?

13 A. That's right; very -- you know, a lot of pollution-
14 intolerant taxa.

15 Q. Now let's look at the CHIA on page 562 and 563.

16 A. Okay.

17 Q. Does the CHIA indicate that there was some mining in the
18 Right Fork watershed before the mining started?

19 And if you'll especially turn your attention to the last
20 sentence in the --

21 A. "Other permitted mining within the Cumulative Impact Area
22 are four S & K Corporation permits in the Right Fork of
23 Leatherwood Creek watershed."

24 Q. Okay. And then go down to the next paragraph and read
25 the first sentence.

Palmer - Direct

1 A. "Along the east side of the Right Fork of Leatherwood
2 Creek and Cannel Coal Hollow, there are four pre-law deep
3 mines."

4 Q. Okay. So that's the state on the ground before mining
5 began.

6 A. That's correct, before Fola mining began.

7 Q. You're right, before Fola mining began.

8 Let's turn, if we could, to Plaintiffs' Exhibit 44. It
9 should have figure 10.

10 Do you have that?

11 A. No, I don't.

12 THE COURT: 44?

13 MR. LOVETT: 44.

14 THE COURT: That's figure 9.

15 MR. LOVETT: Okay.

16 THE WITNESS: I don't have a figure --

17 MR. LOVETT: And mine says 10.

18 THE WITNESS: Oh, I have figure 9 under 43.

19 MR. LOVETT: Yes. 43 should be figure 9. 44 should
20 be figure 10. Is it not in your book?

21 THE WITNESS: I have it in 45. I have figure 10 --
22 from my report? Is that what we're looking at?

23 MR. LOVETT: It is. 45 should be figure 11.

24 THE WITNESS: No. Let's see. So it turns out 10
25 and 11 are under 45. So could I just move this one to 44?

Palmer - Direct

1 (Mr. Hecker and Mr. Lovett conferred privately off the
2 record.)

3 BY MR. LOVETT:

4 Q. Okay. Well, let's look at the page -- so what I'm trying
5 to find is --

6 A. Do you want figure 10?

7 Q. -- PE 0124.

8 A. 124?

9 Q. Uh-huh.

10 A. Yes, I've got that now.

11 Q. And just out of curiosity, which exhibit is that? It's
12 45 for you?

13 A. I moved it to 44 because there were two pages --

14 Q. Okay. All right. So we've got it figured out.

15 All right. So, anyway, PE 0124, did you prepare that?

16 A. Yes. This is from my report.

17 Q. And does it show the levels of sulfate and conductivity
18 in 1999 and 2000 prior to the beginning of Fola 4A?

19 A. That's correct, it does.

20 Q. And what does it show about the level of water quality in
21 Right Fork?

22 A. Well, if you look at SC, there's conductivity in P-9,
23 P-10, and P-11. You see that particularly in 9 and 10 --

24 Q. Uh-huh.

25 A. -- conductivity is usually below the benchmark, but

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1 there's certainly times when it is above the benchmark,
2 getting as high as, on one date, you know, maybe 1500,
3 often -- well, there's three points that are above that in
4 P-9. And those range from 500 to a little over 1000. So it's
5 sporadic.

6 Q. So before Fola 4A on this particular mine site, there was
7 already some high conductivity levels from time to time,
8 right?

9 A. In certain places. It really depended on where you
10 sampled because the mining was in certain places, the pre-Fola
11 mining.

12 Q. That's because of mining pre-Fola.

13 A. That's correct.

14 Q. Okay.

15 A. Or I should say the inputs were from pre-mining.

16 Q. Okay. Let's turn to Joint Exhibit 23. Remember, it's
17 joint exhibit. It should be the last exhibit in the first
18 book, the joint exhibits.

19 A. Okay.

20 Q. And this should be "An Ecological Assessment of the Elk
21 River Watershed" prepared by the West Virginia Department of
22 Environmental Protection. Is that right?

23 A. That's correct, in 1997.

24 Q. Again, before Fola 4A, right?

25 A. Correct.

Palmer - Direct

1 Q. Would you turn to JE 1375, which is the last page of that
2 exhibit?

3 "Upper Elk River Watershed Sites." Do you see that?

4 A. Well, I don't have those numbers, so I'm trying to find
5 where you are because I'm trying to get --

6 Q. I'm sorry. Of the three pages in Exhibit 23, it's the
7 last one.

8 A. There's three pages?

9 Q. In mine.

10 A. There's a whole bunch in mine.

11 Q. Well, it's 68 --

12 A. What's the page number in the report for --

13 MR. LOVETT: May I approach, Your Honor? I'll just
14 show the witness what I have.

15 THE COURT: Yes, you may.

16 BY MR. LOVETT:

17 Q. It's that chart. It's JE -- you don't have a JE number.

18 A. I don't, but I think I can go to page 68 probably of the
19 report.

20 Okay. I'm with you now.

21 Q. Do you have it?

22 A. Yes.

23 Q. Let me make sure the record is as clear as mud, if we
24 can. This is page 68, which is Bates number JE 1375, which
25 you don't have, I understand, and it's the Upper Elk River

Palmer - Direct

1 Watershed sites pre-mining data, right?

2 A. Yes, it is.

3 Q. And do you see where it says "Right Fork/Leatherwood" --

4 A. I do.

5 Q. -- about halfway down? And what does that show for a
6 WVSCI score?

7 A. 84.49. Excellent.

8 Q. An excellent WVSCI score. And what does it show for
9 habitat?

10 A. 197. Also excellent.

11 Q. So pre-mining, Right Fork/Leatherwood, excellent shape
12 all around, right?

13 A. That's correct, where these samples were taken, correct.

14 Q. Now, let's turn to Plaintiffs' Exhibit 73, which is the
15 stipulations of the parties.

16 A. Okay.

17 Q. And let's look at paragraph 31 on page 18 of the joint
18 stipulation.

19 A. Okay. Potesta results?

20 Q. Potesta data. And what years are these from?

21 A. 2001 it appears to be.

22 Q. Okay.

23 A. 2000 and 2001.

24 Q. And this is prior, again, to 4A, right?

25 A. That's correct, it's prior to that.

Palmer - Direct

1 Q. Now, are the WVSCI scores, RBP scores, and conductivity
2 levels from those reports shown in this paragraph?

3 A. They are.

4 Q. Okay. Could you focus on Fola 6 and Fola 7?

5 A. Yes.

6 Q. And where are those two sites located in the Right Fork,
7 if you know?

8 A. I believe they correspond to 9 and 10 that we were just
9 talking about, the sampling sites --

10 Q. Uh-huh. Okay. And --

11 A. -- the 9 and 10.

12 Q. Do you want to get that map?

13 A. Yeah. If I could see the map, it would help.

14 Q. Put a Google Earth depiction up. This will help everyone
15 orient ourselves.

16 Can you explain that map, as well as you can?

17 A. Yes, to the best of my knowledge. So the 9 and 10 are
18 down to the upper -- they're in the upper left part of the
19 image. And I believe that is on the main stem part of the
20 river network.

21 Q. Uh-huh.

22 A. And then Fola 18, 19, 20 is over near --

23 Q. Okay.

24 A. -- one of the -- yeah, one of the tributaries. I'm
25 trying to remember now if it's Cannel or if it's Rocklick.

Palmer - Direct

1 I'll have to look -- let me look at another map.

2 THE COURT: So you're saying 9 and 10 are on
3 Leatherwood Creek?

4 THE WITNESS: No. I'm sorry. Main stem of Right
5 Fork.

6 THE COURT: Right Fork?

7 THE WITNESS: That's correct. And I'm sorry.
8 Rocklick is the one that's in where 19, 20 -- 18, 19, and 20
9 are in Rocklick, which is a tributary to Right Fork.

10 BY MR. LOVETT:

11 Q. Okay. So let's look at these data on this table because
12 I'd like you to explain some things about it. For instance,
13 in many cases, we have very good WVSCI scores and high
14 conductivity.

15 Do you see some of those?

16 A. Yes. So a good example would be --

17 Q. Yeah.

18 A. -- if you look at -- so Fola 19 --

19 Q. Uh-huh.

20 A. -- you see -- look at that conductivity. 2025. Very
21 high. But the WVSCI scores are very good, 87 and 92.

22 Q. Right.

23 A. And if you look at Fola 20, though, you see a very low
24 conductivity and good WVSCI scores. One is a little marginal.

25 No, it's not. I'm sorry. 75. They're all good. And so

Palmer - Direct

1 what is going on there is that you've got parts of the
2 watershed impacted by mining -- remember, this is pre-Fola's
3 mining -- but parts of the watershed that aren't.
4 Specifically where 20 is has not been impacted by mining, and
5 so there's healthy individuals in that that undoubtedly drift
6 downstream. And so you could get healthy organisms because
7 they're drifting through in sections of what 20, that little
8 bitty trib, flows into, just because they're drifting, even
9 though --

10 Q. That's exactly what the Pond 2014 paper predicted would
11 happen.

12 A. It is. It is widely known. I mean, drift has been
13 studied in streams for 50 years.

14 Q. So you don't even have it from Pond, but you know it from
15 your general ecological experience, right?

16 A. Oh, yeah. I spent years studying invertebrate drift
17 myself. I know it's a function of flow, a function of all
18 sorts of things.

19 Q. This isn't a particular case you would really expect
20 that. It's not like this is an all-purpose explanation every
21 time you have the --

22 A. No, it's not -- that's right. It's not like I'm just
23 saying, oh, well, maybe it's because they're drifting.

24 Q. Explain one more time how -- why in this particular
25 situation you attribute it to drift, whereas you may not

Palmer - Direct

1 somewhere else.

2 A. Because the small trib that drains into Rocklick, which
3 is at 20, Fola 20, is an area that hasn't been disturbed by
4 mining. It's got healthy organisms. Organisms always enter
5 the drift. A certain fraction of them is always in the water
6 column. And so those could easily be entering the samples
7 that are collected at Fola 18 and 19.

8 Q. Okay. Let's look at, particularly, at 6 and 7 since
9 those are the ones that we're interested in here. They have
10 relatively high conductivity, right?

11 A. That's correct. So if you go much further downstream
12 where Fola 6 and 7 is, which is down near those other P-9 and
13 P-10 sites we talked about earlier, you see that conductivity
14 is much lower but it's elevated, and you get, you know, WSCI
15 scores that are fairly good, except for Fola 6 in the spring
16 is low.

17 So you can get results that are counterintuitive if you
18 don't understand where trib inputs are and where mining is.

19 Q. So on a site-specific basis, these are explained by
20 drift.

21 A. That's what I would -- that would be my explanation. It
22 doesn't make sense otherwise.

23 Q. Okay. Thank you. Let's turn to Plaintiffs' Exhibit 45.

24 A. Okay.

25 Q. And is this figure 11 that you prepared?

Palmer - Direct

1 A. It is figure 11 from my report.

2 Q. Okay. Did you prepare this after reviewing data showing
3 the levels of sulfates and conductivity at monitoring points
4 P-10 and 11 after the beginning of mining at 4A?

5 A. That's what these figures are intended to show, what the
6 numbers look like, the conductivity and sulfate --

7 Q. Okay.

8 A. -- look like after Fola mining began.

9 Q. And did those data show an increase in sulfate and
10 conductivity since the mining began?

11 A. They do, significant increases at these same very sites,
12 8, 9, and 10 and so forth where we just said that
13 conductivities were, in some cases, up to 700 but not terribly
14 high, and you see that at P-9, for example, conductivities
15 reached over 3000. Same thing at site P-10. They're over --
16 they're at 2000 or over. And the same thing at P-11.

17 Q. As far as you know, is coal mining the only developed
18 land use in the Right Fork watershed?

19 A. As far as I know, yes, sir.

20 Q. Okay. Let's turn to the next exhibit, 40, which should
21 be figure 12.

22 Did you prepare that? Is that right?

23 A. This was in my report, yes.

24 Q. And you prepared it after reviewing the data showing the
25 levels of conductivity discharges from Outlets 022, 023, and

Palmer - Direct

1 027 in years 2012 and '13, right?

2 A. That's correct. This figure is analogous to the one we
3 looked at for Road -- Road Fork.

4 Q. Right. And what are the levels of conductivity in those
5 discharges, generally?

6 A. So the conductivity levels in, between 2011 and 2014, in
7 Road Fork are up to as high as, I don't know, three thousand
8 and one hundred or two hundred. Very high conductivity.

9 Q. How does that compare to the conductivity prior to Mine
10 4A?

11 A. The -- it's significantly higher, much, much higher.
12 Even due to areas -- even in areas where you had some pre-Fola
13 mining, this is higher.

14 THE COURT: I'm sorry to interrupt you. I've been
15 trying to keep up with these, and I don't see Exhibit 40 that
16 looks like what Dr. Palmer is testifying about. In fact, my
17 Exhibit 40 has a PE number 0119, and it's already been
18 different --

19 MR. LOVETT: It's 46, Your Honor.

20 THE COURT: 46.

21 THE WITNESS: Well, that explains why I'm looking at
22 this for Road Fork.

23 MR. LOVETT: I apologize. Let's just strike that
24 whole line of questioning.

25 THE WITNESS: I thought it was a little odd.

Palmer - Direct

1 BY MR. LOVETT:

2 Q. Let's turn to 46.

3 A. Okay. 46. Now we're looking at outfall data.

4 Q. Okay. So --

5 THE COURT: Figure 12?

6 MR. LOVETT: Figure 12.

7 THE WITNESS: From my report.

8 BY MR. LOVETT:

9 Q. From your report. And this is after reviewing data
10 showing the levels of conductivity in discharges from Outlets
11 022, 023, and 027, right?

12 A. That's correct.

13 Q. And, again, level of conductivity, is it high?

14 A. The levels of conductivity are very high. In 022 you see
15 it reaching up to over 4000 microsiemens. Similarly in 023 it
16 reaches that level at least once, and the same with 027.
17 Very, very high levels of conductivity compared to pre-mining.

18 Q. Okay. Now, let's look at the biological sampling
19 downstream in 2012. Let's start at Plaintiffs' Exhibit 48 at
20 PE 0128, figure 14.

21 A. Yes.

22 Q. Did you prepare that?

23 A. It was from my report.

24 Q. Yes. And do they show the WVSCI scores in Right Fork
25 downstream from Outlets 022, 23, and 27 in the Spring of 2012?

Palmer - Direct

1 A. Yes, it does, and it shows that the WVSCI scores are very
2 low, even as low as below 20.

3 Q. Okay. So that's showing significant impairment, right?

4 A. That's on Right Fork. Yes, sir, significant impairment.

5 Q. Okay. Let's go back to Exhibit 73, paragraph 36.

6 Exhibit 73 is the stipulation. 36 I think is that same
7 paragraph that we were --

8 A. What's the page number, please?

9 Q. I'll find you the Bates number.

10 A. PE --

11 Q. The Bates number is PE 0218.

12 A. Okay.

13 Q. Paragraph 31.

14 Do you remember that? 36. Paragraph 36.

15 THE COURT: Well, wait. Paragraph 31 is what we
16 talked about earlier that's at 218.

17 MR. LOVETT: You're right. I want to go to
18 paragraph 36 on PE 0222.

19 THE WITNESS: The chemistry results at those sites?
20 Is that where you want to be?

21 BY MR. LOVETT:

22 Q. Yes. Should be on pages 222 and 223.

23 A. Okay.

24 Q. How does the ionic signature shown by those chemical
25 concentrations compare to the ionic signature of alkaline mine

Palmer - Direct

1 drainage in streams affected by mountaintop mining and valley
2 fills in Central Appalachia?

3 A. Well, it's consistent in terms of the ionic constituents
4 that are elevated, like calcium, magnesium, you know,
5 particularly sulfate, and pH indicates it's alkaline, and the
6 conductivity is highly elevated.

7 Q. Let's turn to paragraph 38 at PE 0225.

8 A. Okay.

9 Q. Do you see the table there?

10 A. I do.

11 Q. What does it show?

12 A. Well, it shows the -- some chemistry in pre-mining
13 samples, which would be the Fola 6 and 7 taken in '01 and
14 '02 --

15 Q. Uh-huh.

16 A. -- and in samples taken by Fola from just downstream of
17 their outlets after they had started mining, so sort of pre
18 and post.

19 Q. Okay.

20 A. The first two rows are pre, and the second two rows are
21 post.

22 Q. Is there a significant increase in ionic chemicals and
23 conductivity?

24 A. There's a very significant increase, from, you know, 367
25 to 461, all the way up to, after mining, 1538 to 1689

Palmer - Direct

1 microsiemens.

2 Q. Okay. So mark this with your finger, if you would, and
3 let's turn to paragraph -- table 6, which is at Plaintiffs'
4 Exhibit 49.

5 I want you to compare Plaintiffs' Exhibit 49 numbers with
6 these. Table 6, which is PE 0129 --

7 A. Okay.

8 Q. Do you see that? That adds four rows below the ones that
9 we just looked at in paragraph 38, right?

10 A. Yes. It appears that the first four rows are exactly
11 what we were looking at, but now there's four more rows that
12 have --

13 Q. I guess we don't need to save our place if they're --

14 A. Look to be the same. Yeah, they are.

15 Q. So what do those new rows show?

16 A. Well, it just shows that the chemistry of the water
17 coming from the outlets is quite elevated; and, of course, not
18 surprisingly, the conductivity is even higher than in the
19 stream because you have a little dilution when outlet water
20 flows into the stream.

21 Q. So these were measured in 2014 by Evan Hansen, right?

22 A. Yes.

23 Q. And Mr. Hansen, as far as you understand, was hired by
24 the plaintiffs to do this sampling.

25 A. That's my understanding from the report --

Palmer - Direct

1 Q. Okay.

2 A. -- that was shared with me that he had done.

3 Q. So, in addition, how do they compare to the levels at
4 Boardtree Branch measured by Kuntz in his 2013 paper?

5 A. So what you see is that the conductivity levels in
6 Boardtree Branch were comparable to what was going on in the
7 outlet. In other words, elevated levels.

8 Q. Uh-huh.

9 A. Alkalinity is elevated. Calcium, magnesium elevated. In
10 other words, you have that characteristic signature again of
11 high sulfate, high -- other ions that are high, and then
12 elevated conductivity.

13 Q. So this has the same ionic signature as the water that
14 Kuntz used, right?

15 A. That's correct, the water that Kuntz reconstituted to
16 test some mayflies in and other organisms.

17 Q. Let's turn to Plaintiffs' Exhibit 25, which should be
18 PE 048.

19 A. Okay. This looks like Dr. Swan's data.

20 Q. Again, Dr. Swan will testify probably right after you.
21 He's a witness for the plaintiff, right?

22 What did Dr. Swan find the WVSCI score to be when he
23 sampled Right Fork in May of 2014?

24 A. The WVSCI score was 38.21, and the GLIMPSS was 25.79.

25 Q. Okay. Did he measure -- let's also look at the RBP at

Palmer - Direct

1 Plaintiffs' Exhibit 32 that he did.

2 Plaintiffs' 32 is an RBP that Dr. Swan did on that
3 stream.

4 A. Yes.

5 Q. Do you see that?

6 A. I do.

7 Q. And he didn't total it, I think, again, right?

8 A. Maybe it's the one that was 172. I remember --

9 Q. It was 172.

10 A. They were not bad. I remember that.

11 Q. Okay. If it does total to 172, which I'll represent to
12 you it does, what does that tell you about the habitat at that
13 stream?

14 A. It's good habitat.

15 Q. Good habitat?

16 A. It's fine. It's not a problem.

17 Q. So could the RBP score cause the low WVSCI score that we
18 saw in, just now, in Exhibit 25 at PE 0048?

19 A. No. No. It's good habitat. So it would not have caused
20 it.

21 Q. Again, did he find any mayflies in Right Fork?

22 A. No. I remember clearly that none of these mine sites had
23 any mayflies when he sampled.

24 Q. So do you attribute the cause of the impairment to
25 conductivity and not to habitat?

Palmer - Direct

1 A. I have no doubt it's conductivity and not habitat.

2 Q. Okay. And last was -- we're almost finished. Let's look
3 at Plaintiffs' Exhibit 50 and 51.

4 Is Plaintiffs' Exhibit 50, which is figure 15, something
5 you prepared?

6 A. This is from my report, yes, showing the habitat scores.

7 Q. Okay. And let's also look at 51, table 7.

8 Do you see that?

9 A. I do.

10 Q. So would you explain the relationship between those two
11 exhibits?

12 A. Well, this is just showing that, you know, okay, in the
13 graph, figure 15, you know, you see that in Right Fork,
14 habitat is generally around -- looks like 130 to 140, but in
15 Leatherwood, you know, it's a little -- it appears to be a
16 little more variable; sometimes higher, sometimes slightly
17 lower.

18 And if you look at data that include older numbers, you
19 know, what you see is the same sort of range, that is, you
20 know, sometimes like excellent habitat in 1997 of 195, and
21 yet habitat that is suboptimal, you know, on another date
22 later.

23 So it varies, but none of these are, like, marginal or
24 poor, not a single one.

25 Q. All decent habitat?

Palmer - Direct

1 A. That's right, all decent habitat; yes.

2 Q. So in your opinion, that habitat cannot be responsible
3 for the low WVSCI scores.

4 A. Correct.

5 Q. And, again, it's your opinion that the low WVSCI scores
6 are caused by the conductivity or the ionic mixture in the
7 streams, right?

8 A. It is my opinion.

9 Q. Let's move to the last mine, No. 6, at Cogar Hollow
10 tributary. Start with Plaintiffs' Exhibit 52, getting back to
11 the map.

12 A. Okay.

13 Q. Does this map show the location of Mine 6?

14 A. It does. It shows Cogar Hollow.

15 Q. Uh-huh.

16 A. And it shows the valley fills. There's three valley
17 fills.

18 Q. Right.

19 A. And they all empty into Cogar Hollow, which drains into
20 Leatherwood.

21 Q. Could you point to the Court and show the Court where
22 monitoring point S3-1A is?

23 A. It doesn't have any colors on it, so it's a little hard
24 to see, but it's right here. (Indicating)

25 THE COURT: 1A?

Palmer - Direct

1 THE WITNESS: 53-1A, yes.

2 BY MR. LOVETT:

3 Q. Let's turn to Plaintiffs' Exhibit 53. Does this map show
4 a close-up of the three valley fills?

5 A. Yes, it does.

6 Q. And could you point out on the map where Outlets 15, 13,
7 and 17 are?

8 A. Sure. So Outlet 15 -- so here's one valley fill, and
9 Outlet 15 looks to be perhaps right below that pond. And then
10 113 is further on downstream in Cogar Hollow.

11 And then, I'm sorry, what was the third one you wanted me
12 to show? 15, 13, and was it 17?

13 Q. 17.

14 A. And so 17 is over here and drains -- looks like it gets
15 receiving water from the pond that's draining the valley fill
16 of this site. (Indicating)

17 Q. And those outlets drain the three valley fills on the
18 mine, right?

19 A. That looks to be the case. 013 it's a little harder to
20 tell if it's right at the base of the pond, but from this map,
21 it is anyway. But it is just below that valley fill where it
22 comes in presumably.

23 Q. Okay. Let's turn to Plaintiffs' Exhibit 126,
24 one-two-six, which should be the CHIA for this mine. It's
25 Bates number 1337. Do you see that?

Palmer - Direct

1 A. I do.

2 Q. CHIA performed in 2000 by DEP?

3 A. Yes.

4 Q. Okay. Let's turn to page 1353.

5 Do you see that?

6 A. I do.

7 Q. And do you see where it describes Cogar Hollow water or
8 the Cogar Hollow watershed?

9 A. Yes, under -- where it says "S-31A (Cogar Hollow)"?

10 Q. Uh-huh.

11 A. Yes.

12 Q. And one thing it points out is that it's above the
13 influence of any mining, right? It's the first sentence.

14 A. It says it's above the influence of any mining, S-31A.

15 Q. So as of --

16 A. This would be at that time.

17 Q. It's no longer the case, is it?

18 A. Right, it's no longer.

19 Q. But in --

20 A. '99 it was.

21 Q. Yeah. When the CHIA was performed, it was above all
22 mining.

23 A. That's correct.

24 Q. And then let's turn to page 1361 of the CHIA. And these
25 are the baseline benthic monitoring results from pre-mining.

Palmer - Direct

1 Do you see that for Cogar Hollow?

2 A. I do.

3 Q. Would you read the paragraph that begins "In general."

4 It's the second full paragraph on the page.

5 A. "In general, all stations provide adequate habitat and
6 contain populations of benthic macroinvertebrates. All
7 stations have high EPT indices."

8 Q. Just continue and read the paragraph, if you would.

9 A. "This index relates the total number of organisms found
10 to the number of organisms which belong to the orders
11 Ephemeroptera (Mayflies), Plecoptera, or stoneflies, or
12 Trichoptera (Caddisflies)."

13 Q. Go ahead.

14 A. "Pollution intolerant, high water quality organisms are
15 represented by these three orders. If the percentage is high,
16 it is safe to say in most cases that the water is of high
17 quality."

18 Q. Do you agree with that?

19 A. I do agree with that.

20 Q. Okay. So that's pre-mining.

21 Let's turn to Plaintiffs' Exhibit 54. Again, you
22 prepared these, right, that figure 18?

23 A. Yes. This is from my report.

24 Q. Okay. And these are from your review of levels of
25 conductivity and sulfate in Cogar Hollow at point S-31A prior

Palmer - Direct

1 to mining, right?

2 A. That's correct.

3 Q. Prior to Mine 6.

4 A. Prior to Fola's mining, yes.

5 Q. Is the data supporting that figure -- I'm sorry. What do
6 those data show?

7 A. The data show that conductivity is almost always well
8 below the threshold level of 300 microsiemens, and the
9 sulfates are quite low as well.

10 Q. Okay. Let's look at Plaintiffs' Exhibit 55, figure 19.

11 And those are data showing the levels of conductivity and
12 sulfate in Cogar Hollow at point S-31A after mining at 6 has
13 begun; is that true?

14 A. Yes, it is.

15 Q. And what do those data show?

16 A. It shows that after Fola mining, the conductivity levels
17 are very high, between four and maybe fifty-five hundred
18 microsiemens. Sulfates are high. This is among the highest
19 sulfate levels I've ever seen, over 3000 milligrams per liter
20 at one point. And so it's got water quality problems.

21 Q. Okay. And is mining the only land use in Cogar Hollow
22 watershed?

23 A. That's correct.

24 Q. Okay. Let's look at Plaintiffs' Exhibit 56, figure 20.

25 And are those -- was that prepared with data showing

Palmer - Direct

1 levels of conductivity and sulfate discharge from Outlets 13,
2 15, and 17 from Mine 6 in 2011 and 2012?

3 A. That's correct. This shows the levels in those outfalls.
4 One of each is associated with those valley fills or the
5 ponds, below the ponds.

6 Q. Post mining, obviously.

7 A. Post mining.

8 Q. And what do those data show?

9 A. It just shows that the conductivity is very elevated, so,
10 you know, similar to what, you know, we saw at the sites. You
11 see conductivity levels in Outfall 13, for example, of nearly
12 5000 on one date. They're all highly elevated, nowhere near
13 the benchmark level.

14 Q. Okay. Let's turn to the next exhibit, table -- which is
15 table 8 in Plaintiffs' Exhibit 57 at PE 137.

16 Do you see that?

17 A. Yes.

18 Q. Have you reviewed the data showing the mixture -- showing
19 the ionic mixture of the chemicals discharged here from
20 Outlets 13, 15, and 17?

21 A. Yes, that's correct.

22 Q. Okay. And are those in different years? Are those in
23 years 2007, '12, and '14?

24 A. Yes. And they all have conductivity levels well over --
25 in this case, well over 1800, at 1800 or above.

Palmer - Direct

1 Q. So Mr. Hansen's conductivity number from 2014 is --

2 A. I apologize. I was looking at hardness. I'm sorry.

3 The conductivity is present for Mine 6 outlet a number of
4 3420 in 2007.

5 Q. Right.

6 A. And Hansen in 13 measured 4200.

7 Q. Okay. And then on Boardtree Branch too, is there --

8 A. It just shows the same characteristic signature for a
9 comparison point.

10 Q. Uh-huh. Okay. Extremely elevated in 2014, though,
11 right?

12 A. Very elevated.

13 Q. And just the last row of Boardtree Branch, again how does
14 that compare to what Kuntz measured in 2013?

15 A. Well, once again, he reconstituted the water that had a
16 characteristic ionic signature like Boardtree Branch and then
17 showed that it significantly impacted mayflies.

18 Q. At 1090?

19 A. At 1090.

20 Q. Now it's --

21 A. -- four times that almost.

22 THE REPORTER: I'm sorry. I'm sorry. Did you say
23 "four times"?

24 THE WITNESS: Almost four times, yeah.

25 BY MR. LOVETT:

Palmer - Direct

1 Q. This may be the last exhibit. Would you turn to
2 Plaintiffs' Exhibit 25. Again --

3 A. Dr. Swan's samples.

4 Q. These are Dr. Swan's WVSCI scores, right?

5 A. That's correct. Cogar Hollow WVSCI was 41.81 when he
6 sampled and the GLIMPSS score was 20.03, both showing high
7 levels of impairment biologically.

8 Q. So a big change before and after mining at Cogar Hollow.

9 A. Huge change.

10 Q. Both in water quality and in WVSCI.

11 A. Correct.

12 Q. They go together, right?

13 A. They go together. The change in water chemistry was the
14 cause of the biological impairment.

15 Q. Of course, I didn't tell the truth. Let's do one more
16 thing. Let's look at Plaintiffs' Exhibit 30, which is
17 Dr. Swan's RBP.

18 A. And you get to tell me when you added it up what it is.
19 I don't remember.

20 Q. Has anyone added this one?

21 If it's 145, what does that tell you about the site?

22 A. It tells me that it's, you know, it's suboptimal, almost
23 optimal, but not quite. So it's a fine habitat score. It's
24 not at all an uncommon score to get in streams.

25 Q. Could that habitat score have caused the impairment?

Palmer - Direct

1 A. Absolutely not.

2 Q. Do you have any doubt that in Cogar Hollow again that it
3 is the elevated conductivity and the associated ions that are
4 causing the impairment?

5 A. That's correct. I feel certain that that is what is
6 going on.

7 (Mr. Hecker and Mr. Lovett conferred privately off the
8 record.)

9 BY MR. LOVETT:

10 Q. So just to sum up, is it your opinion that at all three
11 mines, there's impairment?

12 A. It is my opinion that at all three mines, there's
13 impairment, and that in two of those mines, there was no prior
14 impairment from earlier mining, and the -- and they are
15 impaired now. In one of them, there were some low WVSCI
16 scores or higher conductivities at select sites, but there
17 were also sites that were sampled after mining pre-Fola that
18 were good, and yet post-Fola mining there showed impairment at
19 all the sites and elevated conductivity throughout, much
20 higher.

21 Q. Just to finish, Road Fork and Cogar Hollow, pre-mining,
22 the streams were in good condition and the habitat was in good
23 condition.

24 A. That's correct.

25 Q. There was no mining in those -- no significant mining in

Palmer - Direct

1 those watersheds.

2 A. Correct, my understanding.

3 Q. After mining, that had completely changed so that we have
4 impairment and high conductivity.

5 A. That's correct.

6 Q. You have no doubt that that conductivity -- that that
7 impairment is caused by the conductivity, right?

8 A. I have no doubts.

9 Q. And in Right Fork, there was some pre-mining elevated
10 conductivity, correct?

11 A. That's correct, there were at some particular spots.

12 Q. And WVSCI scores varied from time to time.

13 A. They varied.

14 Q. But since mining, the conductivity has become much more
15 elevated than it was before mining.

16 A. Correct.

17 Q. And the WVSCI scores have gotten worse too.

18 A. That's correct.

19 Q. Okay. And, again, you think that's caused by -- that the
20 impairment there is caused by conductivity.

21 A. I do.

22 Q. Okay. Do you hold all the opinions that you've testified
23 to to a reasonable degree of scientific certainty?

24 A. I do. I hold them to a level of high certainty.

25 MR. LOVETT: That's all.

Palmer - Cross

1 THE COURT: All right. We'll take a ten-minute
2 recess before cross.

3 (Recess from 3:53 p.m. to 4:07 p.m.)

4 THE COURT: All right.

5 CROSS-EXAMINATION

6 BY MR. MCLUSKY:

7 Q. Let's get the important thing out of the way first. When
8 you say you have a home in West Virginia on a river, you're in
9 Paw Paw, West Virginia, somewhere thereabouts?

10 A. I am.

11 Q. On what river?

12 A. It's the Cacapon, which is a major tributary to the
13 Potomac. Is that -- that's in West Virginia.

14 Q. Not very far in West Virginia, is it?

15 A. No.

16 Q. Let's put up -- Mr. Tyree, if you could -- Plaintiffs'
17 Exhibit 42, page PE 122, which, Dr. Palmer, I put up on the
18 screen. And I'll have Mr. Tyree blow it up, if you'd like, on
19 either screen. But I think this is your figure 8 from your
20 report.

21 Does that look right?

22 A. It does look correct.

23 Q. I have a couple questions here. This is the Right Fork
24 watershed is my understanding; is that correct?

25 A. Yes.

Palmer - Cross

1 Q. Okay. And you pointed out earlier we had Outlets 022,
2 023, and then -- in the Right Fork; and then over in Cannel
3 Coal Hollow, I think it's called, Outlet 027; is that correct?

4 A. Right.

5 Q. Those are the three outlets at issue in the Right Fork
6 watershed?

7 A. These are ones for which we had data that we talked about
8 at various points.

9 Q. Okay. And then you talked about Dr. Swan's WVSCI
10 sampling. Do you recall that?

11 A. I do.

12 Q. Okay. Do you know how and where on figure 8 he did his
13 WVSCI sampling?

14 A. I do not.

15 Q. Do you know whether it was below the confluence of Cannel
16 Coal Hollow and the main stem of Right Fork so that he could
17 pick up the discharges from all three of the outlets you just
18 mentioned?

19 A. I don't recall.

20 Q. Okay. If you assume that he sampled below the
21 confluence, he'd have to sample below the confluence to get
22 the drainage from all three of the outlets you just mentioned,
23 wouldn't he?

24 A. That's correct.

25 Q. Okay. And if he did so -- I'm just looking in the Right

Palmer - Cross

1 Fork watershed between Outlet 022 and the confluence with
2 Cannel Coal Hollow. And at least on your map, I see Outlet
3 024, Outlet 021, Outlet 025, Outlet 020, and 028 that are
4 located between Outlets 023, 022, and the confluence with
5 Cannel Coal Hollow; is that correct?

6 A. Yes.

7 Q. Okay. So if his sampling was done below the confluence,
8 it didn't isolate the effects of just discharges from 022 and
9 023 in the main stem of Right Fork, did it?

10 A. No, that would be correct.

11 Q. Okay. Let's talk about Cannel Coal Hollow. The same
12 thing is true in Cannel Coal Hollow.

13 If he sampled -- his benthic scoring was done in the main
14 stem below the confluence and his goal was to pick up or
15 isolate the effect of Outlet 027, he failed at that because he
16 also picked up the effect of other outlets shown in Cannel
17 Coal Hollow in your map as 001, 002, 020, 26, 031, 003, 030,
18 and 004; isn't that right?

19 A. You would be correct, and I don't know if his goal was to
20 try and isolate individual outlet impacts.

21 Q. I think in the Stillhouse trial, which I think was our
22 last visit here, among many, I think you testified there that
23 you suggested particular pollutants such as selenium and
24 manganese can themselves cause stress to aquatic organisms by
25 getting in the food web; is that correct?

Palmer - Cross

1 A. I don't recall exactly what I said. I'll be happy to
2 look at it if you would show me the passage.

3 Q. Mr. Tyree, could you put up the Stillhouse trial
4 transcript, page 126, please, and line 13, if you could.

5 The question I asked you then, Dr. Palmer, was, "Have you
6 suggested that particular pollutants such as selenium and
7 manganese can themselves cause stress to aquatic organisms by
8 getting in the food web?"

9 And your answer was?

10 A. "I know selenium can."

11 Q. Okay. And I go on to say, "Have you said that some of
12 the more toxic ions, especially selenium, manganese, are known
13 to accumulate at high concentrations in stream biofilm where
14 they may enter the food web?"

15 And your answer was, "I think -- I know that to be the
16 case. I can't remember if I said that in the report. That's
17 a fair statement. I think that's so."

18 Is that true?

19 A. I know that to be the case for selenium. But you're
20 correct, that is what I said in the trial.

21 Q. Did you do any food web work here?

22 A. In these streams, no, sir.

23 Q. And, well, we didn't go over it before. How many visits
24 did you make to this site?

25 A. I was unable to visit this site --

Palmer - Cross

1 Q. So --

2 A. -- which is why I don't know where the sampling --

3 Q. So you haven't been to these sites at all.

4 A. No. I was unable to visit the sites.

5 Q. Let me turn to -- I think it was Joint Exhibit 20, if I
6 might have just a minute, Your Honor.

7 THE COURT: Certainly.

8 BY MR. MCLUSKY:

9 Q. I think, Dr. Palmer, that's the large notebook.

10 May I approach, Your Honor? Maybe I can speed this up.

11 THE COURT: Yes, go ahead.

12 BY MR. MCLUSKY:

13 Q. Instead of you looking for it, I can find it.

14 Dr. Palmer, Joint Exhibit 20 I think is the -- I don't
15 have my copy -- 2012 303(d) list; is that correct?

16 A. That's correct.

17 Q. For the Elk River watershed?

18 A. It appears to be.

19 Q. Okay. And I've tabbed a page. It's called List 11. Is
20 that the page number?

21 A. Yes.

22 Q. Okay. Can you confirm that on that page that Cannel Coal
23 Hollow, which drains out at 027, is not listed for biological
24 impairment but is listed for selenium impairment?

25 THE REPORTER: Listed for what?

Palmer - Cross

1 MR. MCLUSKY: Selenium impairment.

2 A. I can confirm that.

3 Q. Okay. Did you know that before you came here?

4 A. I don't know. I probably saw this, but I don't remember
5 for sure if I have. So perhaps the best answer is no.

6 Q. Were you aware -- I take it you were not aware of the
7 fact, then, that the plaintiffs in this case also sued Fola
8 Coal Company for selenium discharges coming from Outlet 027.

9 A. I know nothing about that.

10 Q. Okay. Mr. Tyree, could you put up a copy of what we'll
11 call Defendant's Exhibit --

12 MR. TYREE: 193.

13 Q. -- 193, which you don't have yet.

14 May I approach, Your Honor?

15 THE COURT: You may.

16 BY MR. MCLUSKY:

17 Q. Dr. Palmer, I will represent that this is a motion for
18 summary judgment filed by the same plaintiffs in this case in
19 an earlier case against Fola Coal Company and ask, if you turn
20 to page 3 and 4 of that document --

21 A. Okay.

22 Q. -- and ask if you can't confirm by looking at the
23 bottom -- the last paragraph on the bottom of page 3 -- Mr.
24 Tyree has it up on the screen too if you'd like to see it --
25 if it doesn't identify selenium sampling points in Cannel Coal

Palmer - Cross

1 Hollow as DCCH (P-9).

2 Do you see that?

3 A. I'm looking at the bottom paragraph?

4 Q. The bottom on page 3, continued over to page 4.

5 A. Yes, I do see that.

6 Q. They identify a sampling point DCCH (P-9) in Cannel Coal
7 Hollow.

8 A. Yes.

9 Q. And they allege that they've exceeded the chronic
10 criterion for selenium at least 41 times between July 2008 and
11 July 2012.

12 Do you see that?

13 A. I do see that.

14 Q. And the acute standard at least 15 times during the same
15 period, correct?

16 A. Correct.

17 Q. If you continue, they go on to say -- they also alleged
18 violations of the selenium chronic concentrations in the Right
19 Fork of Leatherwood Creek at a spot they identify as DRFLC
20 (P-10).

21 Do you see that?

22 A. I do, yes.

23 Q. And then another one further down is DRFLC --

24 A. P-11.

25 Q. -- (P-11).

Palmer - Cross

1 A. Yes.

2 Q. And if you read on, you'll see that they alleged that
3 those -- the information is set out in Exhibit 4 to the motion
4 for summary judgment.

5 Do you see that?

6 A. Would that be -- yes, I do see that. Yes.

7 Q. And then, Mr. Tyree, we have Defense Exhibit 194, which
8 will be Exhibit 4 to the motion for summary judgment.

9 Your Honor, let me get these marked, if I might --

10 THE COURT: Yes.

11 MR. MCLUSKY: -- before I overstep my bounds.

12 May I approach, Your Honor?

13 THE COURT: You may.

14 BY MR. MCLUSKY:

15 Q. Dr. Palmer, I hand you what has been marked as, I think,
16 Defense Exhibit 194 and represent that is Exhibit 4 to the
17 motion for summary judgment that the plaintiffs filed in a
18 selenium case against Fola.

19 And do you see on this document there is a number of
20 selenium data, and you'll see at the top of the exhibit, for
21 example, Instream Monitoring Point P-9 -- Mr. Tyree can
22 highlight that -- (DCCH)?

23 Do you see that on the screen?

24 A. Well, I see it here, yes.

25 Q. Okay. And that would appear to be the same one we just

Palmer - Cross

1 talked about, which is downstream Cannel Hollow, correct, P-9?

2 A. P-9. There is such a site in Cannel Coal.

3 Q. Okay. What we have on here are measurements of selenium,
4 all of which exceed 5 parts per billion; is that correct?

5 A. It appears that way, yes.

6 Q. And some of them are -- I see one --

7 A. Some are very high.

8 Q. Yes. Are these some of the highest numbers you've seen
9 in West Virginia?

10 A. I haven't looked at selenium data in depth in West
11 Virginia, so I can't say that, no.

12 Q. Have you looked at selenium data anywhere?

13 A. A little bit. I mean, I've looked at a little bit in
14 association with mining, yes, but I can't say what the highest
15 numbers are in West Virginia.

16 Q. Are these -- you've done work in the Mud River area?

17 A. I have not worked in Mud River.

18 Q. The chronic criterion you know to be 5 parts per billion?

19 A. I think it is 5, yes.

20 Q. And then if you turn forward, there's similar data both
21 for the instream monitoring points P-10 and P-11, both of
22 which are in the Right Fork of Leatherwood; is that correct?

23 A. That's correct.

24 Q. And all of these numbers exceed the 5; is that correct?

25 A. I'll take your word for it. It certainly looks like it

Palmer - Cross

1 from perusing it.

2 Q. Did anyone tell you what is going on in these watersheds
3 as a result of this lawsuit?

4 A. I'm not sure what your question is.

5 Q. Do you know how one goes about treating selenium?

6 A. No, I do not.

7 Q. Have you ever heard of a biochemical reactor?

8 A. I've heard of bioreactors.

9 Q. Have you ever seen one built?

10 A. No.

11 Q. Can you imagine a very large pond filled with hay, horse
12 manure, and other organic materials?

13 A. I'd rather not, but I could.

14 Q. Is that the type of thing that can have impacts on
15 aquatic organisms?

16 A. It could, yes.

17 Q. You didn't take any of that into account in this case,
18 did you?

19 A. I don't -- I'm not aware of whether there are hay bales
20 and horse manure in these ponds. I have no knowledge of that.

21 MR. MCLUSKY: May I approach, Your Honor?

22 THE COURT: Yes.

23 BY MR. MCLUSKY:

24 Q. Dr. Palmer, I've handed you what will be marked as
25 Defense Exhibit 195 and represent that is a report to the

Palmer - Cross

1 Court by Fola's consulting -- or part of Fola's report to the
2 Court on what actually will be built in some of these
3 watersheds.

4 Mr. Tyree, could you scroll forward in that document?

5 A. What page are you going to?

6 MR. TYREE: Page 5.

7 BY MR. MCLUSKY:

8 Q. Page 5.

9 A. Okay.

10 Q. And ask if this doesn't show above Outlets 022 and 023 a
11 BCR or biochemical reactor plan to be constructed.

12 A. It is so labeled on the figure that. I don't know other
13 than what's labeled on the figure.

14 Q. And there's, further up in the watershed, aeration and
15 polishing pond.

16 And, Mr. Tyree, could you show anything at Cannel Coal
17 Hollow as well?

18 All right. What page is this, Mr. Tyree?

19 MR. TYREE: Page 9.

20 BY MR. MCLUSKY:

21 Q. At page 9 of the report, Dr. Palmer -- it's up on the
22 screen -- you can see these drawings showing a series of
23 trenches, ponds, aeration ponds, polishing ponds.

24 I assume all of this is news to you.

25 A. It's not in page 9 of my report.

Palmer - Cross

1 Q. Okay. Page 7. I'm sorry.

2 A. Okay. I'm sorry. What did you ask me?

3 Q. Do you see pictures of an aeration/polishing pond,
4 collection trenches?

5 A. I see circles and rectangles labeled as such, yes.

6 Q. Okay. And I take it none of these were things that you
7 took into account in your opinions of what might occur or is
8 occurring in this watershed.

9 Is that a fair statement?

10 A. I'm not aware of this information, correct, so I did not
11 take it into account.

12 Q. Mr. Tyree, could you put up Cogar Hollow? And I'm not
13 sure what exhibit it would be.

14 Let's go back to Joint Exhibit 20. I'm sorry, not 20.
15 Plaintiffs' Exhibit 42, that Palmer figure 8.

16 A. 22? 22?

17 Q. 42. Mr. Tyree -- it's your figure 8. He'll blow that up
18 again.

19 A. Yes.

20 Q. All right. Does this show the -- this shows just Right
21 Fork and Cannel Coal Hollow. Does it show the other -- does
22 it show Road Fork and Cogar Hollow as well?

23 A. It shows where Cannel Coal comes into Right Fork.

24 Q. All right.

25 I'll come back to this in a minute, Your Honor.

Palmer - Cross

1 Dr. Palmer, let's kind of go back to some more basic
2 stuff. You've testified before, I think it's true, that
3 you're not a toxicologist; is that correct?

4 A. That's correct.

5 Q. Okay. You're also not a chemist.

6 A. No, I'm not a chemist. We do a lot of biogeochemistry,
7 stream biogeochemistry in my lab; a lot.

8 Q. You're not a chemist, right?

9 A. I wasn't trained as a chemist. It doesn't mean I don't
10 know any chemistry.

11 Q. In fact, your Ph.D. was in what?

12 A. Oceanography.

13 Q. And I think you told us before that you're not an
14 epidemiologist.

15 A. I'm not.

16 Q. You're not an eco-epidemiologist as well --

17 A. No, I'm not.

18 Q. Okay. You've done no field or lab testing to validate or
19 invalidate the work of the benchmark. Is that fair?

20 A. Specifically to validate the benchmark, no, I have not;
21 that's correct.

22 Q. You've done no original lab work investigating the
23 toxicity of alkaline mine drainage on insects at all; is that
24 correct?

25 A. No, I have not.

Palmer - Cross

1 Q. You haven't published papers in what's necessary to
2 establish either a general or specific relation -- causal
3 relationship in the field of aquatic toxicity.

4 A. I'm sorry. I don't understand your question.

5 Q. Have you published anything in the field of aquatic
6 toxicity?

7 A. Well, I'll probably just say no because I'm not exactly
8 sure what you might include in that. I've certainly published
9 in *Environmental Science and Technology* and journals like that
10 with a lot of chemistry in it, but not -- we have not done
11 toxicological testing in my lab.

12 Q. You haven't done any work to verify or rework any of the
13 statistics that were run as part of the benchmark, have you?

14 A. I have not run them myself. I've looked at a lot that
15 has been done by colleagues, by Ryan King, Emily Bernhardt, by
16 others, but I did not run them.

17 Q. And none of that is in your report in this case.

18 A. No, it is not.

19 Q. And while you have used statistics in your work, you
20 don't hold yourself out as a statistician in either, do you?

21 A. No, I do not hold myself as a statistician.

22 Q. Okay. You've done no independent work to determine which
23 constituents comprising conductivity might be responsible for
24 the effects observed by EPA?

25 A. Individual constituents?

Palmer - Cross

1 Q. Correct.

2 A. No, I have not worked on that.

3 Q. Isn't it fair that the benchmark itself does not claim
4 that sulfate or any other particular ion is the primary cause
5 or presence -- or primary cause of the absence of any
6 particular insect?

7 A. The benchmark points to the ionic mixture as the
8 causative agent.

9 Q. And the SAB asked that it could improve its work by
10 looking at the elements of the mixture that might actually be
11 causative; is that not true?

12 A. I seem to recall that that was read, yes, in the
13 testimony.

14 Q. All right. Turning to Joint Exhibit 13, which is Pond
15 2008 -- wait till Mr. Tyree gets there.

16 A. Okay.

17 Q. Mr. Tyree, can you get us to the abstract?

18 Dr. Palmer, is it fair to say that in the -- this is
19 Joint Exhibit 13, the Pond 2008 paper -- that nothing in this
20 abstract claims that either conductivity or sulfate caused any
21 particular effect anywhere?

22 A. Let me read, look at it again.

23 You are correct, it's not in the abstract.

24 Q. And, in fact, Pond simply used conductivity as a
25 surrogate for mining in this paper, did he not?

Palmer - Cross

1 A. I don't know. Let me look again.

2 Q. I direct your attention to page 188 or page 720 of the
3 article, first column.

4 A. I'll get there. Just a minute.

5 Q. It's not a trick question. I asked you this last year.
6 And I can put your answer up, if you'd like, from the
7 Stillhouse case.

8 Would that help?

9 A. I'd like to have time just to look at this.

10 Yes, you're correct. They assigned the ranges based on
11 conductivity because they said the land use data was
12 insufficient to characterize the amount of mining.

13 Q. Okay. Could you turn to page JE 194, which is page 726
14 of the article?

15 A. Okay.

16 Q. There should be a table of correlation coefficients.

17 A. Yes.

18 Q. And I'll ask if Pond in 2008 didn't find a .74
19 correlation coefficient between West Virginia Stream Condition
20 Index scores and RBP habitat scores.

21 A. That's correct; he did.

22 Q. And that's a relatively high correlation, isn't it?

23 A. It is relatively high. I'd want to see the P value, but
24 it's relatively high, yes.

25 Q. And he found for embeddedness a correlation coefficient

Palmer - Cross

1 of .57; is that correct?

2 A. That's correct.

3 Q. Also relatively high.

4 A. Pretty high, yeah.

5 Q. And then if you turn to page 198 of the article, which is
6 page -- or page 198 of the exhibit, page 730 of the article --

7 A. Okay.

8 Q. -- about midway through the first full column.

9 A. Uh-huh.

10 Q. Paragraph -- the second column. I'm sorry. It begins
11 with "Howard."

12 Mr. Tyree has it up.

13 Do you see that?

14 A. It's on page 730 of the article?

15 Q. It's on page, yes, 730 of the article, and I have --

16 A. Left column?

17 Q. Do you see that? It's the second column, first full
18 paragraph.

19 A. Yes, I do. I'm sorry.

20 Q. It begins with "Howard." Could you read that sentence,
21 please?

22 A. "Howard et al. (2001) and Pond (2004) reported that
23 habitat indicators (chiefly sedimentation and embeddedness)
24 were strongly correlated with MMIs and particular metrics in
25 Kentucky headwater streams."

Palmer - Cross

1 Q. And "MMI" is a multi-metric index; is that correct?

2 A. Yes.

3 Q. Just like the WVSCI is, right?

4 A. It's comparable.

5 Q. And then if you turn back to page 194, which is page 726
6 of the article, toward the end of that page --

7 A. Yes.

8 Q. -- you'll see the word "Alternatively." Do you see that?

9 Mr. Tyree has it up if you'd like to see it. It's at the
10 very end of the page.

11 A. "Alternatively, elevated specific conductance might
12 simply be an indicator of mining disturbance, and other
13 mining-related variables (e.g., metal concentrations) might be
14 causing or contributing to the impairment."

15 Q. Could you go on and continue reading the next sentence?

16 A. "Our bioassessment indicators were not strongly
17 correlated with dissolved or total metals concentrations in
18 the water column, but these results do not rule out possible
19 exposure to metals via dietary intake or microhabitat
20 smothering by metal hydroxide precipitate."

21 Q. Okay. Is it fair to say that Pond here in 2008, then,
22 could not rule out dietary uptake of metals, nor could he rule
23 out smothering of insects from metal hydroxide precipitation?

24 A. He had not ruled those out completely, correct.

25 Q. So let me make sure I understand. In 2008, if I'm

Palmer - Cross

1 working in Clay County, West Virginia, at the Fola Mine and I
2 run out to my mailbox to pick up my copy of Pond from the
3 *Journal of North American* --

4 A. *North American Benthological* --

5 Q. Along with *Rods and Reels* and *Guns and Ammo* out there --

6 A. Yes.

7 Q. -- and I pick up and read this article, I'm going to find
8 that he used conductivity as a surrogate for mining; is that
9 correct?

10 A. Correct.

11 Q. Okay. He did not claim that conductivity or any
12 particular component of mine drainage caused any particular
13 impacts.

14 A. He speculated in the discussion, but he -- I agree with
15 you; he could not rule everything out. This was just the
16 study was too early.

17 Q. He found a relatively high correlation between RBP, that
18 is, physical habitat, and the WVSCI or multi-metric indices
19 scores.

20 A. That's correct.

21 Q. He concluded that changes to the multi-metric index
22 scores could be due to dietary uptake, metals, or smothering
23 from metal hydroxide precipitation.

24 A. He speculated. It's purely speculation. And he admits
25 he has no idea if that's possible.

Palmer - Cross

1 Q. And he did not do a confounding factors.

2 A. He did not.

3 Q. All right. I think we went over Plaintiffs' Exhibit 131,
4 which is Pond 2010. Tell me if I --

5 A. 2008 you mean?

6 Q. No, 2010.

7 A. Oh, I'm sorry.

8 Q. "Patterns of Ephemeroptera taxa loss." Did you go over
9 this one earlier with Mr. Lovett?

10 A. Yes.

11 Q. They kind of run together in my head.

12 A. Me, too.

13 Q. Is it fair to say, Dr. Palmer, that likewise in Pond
14 2010, the abstract at least, there's no statement that
15 conductivity, sulfate, or any other chemical constituent can
16 or have caused any particular effect to --

17 A. Can you tell me what the exhibit is, please?

18 Q. I'm sorry. It's Plaintiffs' Exhibit 131.

19 A. Correct. There's no mention of conductivity.

20 Is that what you asked? I think it is.

21 Q. The question was, is it fair to say that nowhere in the
22 abstract does it claim that conductivity or any constituent of
23 conductivity actually causes any particular impacts?

24 A. That's correct. It talks about mining, not about
25 conductivity, in the abstract.

Palmer - Cross

1 Q. And if we turn to page PE 1536 of the same article and
2 look at line 593 --

3 A. Yes.

4 Q. -- is it fair to say here -- could you read this line for
5 us, please, beginning with "Although Pond"?

6 A. "Although Pond (2008) did not find strong correlations of
7 mayfly abundance and richness with mining-related trace metals
8 in the water column (except selenium) they state that possible
9 exposure to metals through dietary uptake or potential micro-
10 habitat smothering by metal hydroxide precipitate or iron
11 bacteria blooms could not be ruled out."

12 Q. Okay. So this is Pond in 2010 reiterating what he says,
13 at least in part, in 2008; is that correct?

14 A. Reciting 2008.

15 Q. But with one important additional statement here. He
16 actually says in 2010 he found in 2008 a strong correlation
17 between mayfly abundance and selenium; is that not correct?

18 A. Well, it's not clear if it's mayfly abundance or
19 richness, but, yes, it does say except selenium, so that's
20 correct.

21 Q. All right. Let's turn to Plaintiffs' Exhibit 141, which
22 is Pond 2014.

23 A. Okay.

24 Q. I think this is the paper in which Pond compared some
25 reference streams to some valley filled sites that had been

Palmer - Cross

1 minded quite sometime ago; is that correct?

2 A. Yeah, these are the -- he went back to reclaimed sites
3 and sampled streams below those where they had good habitat --

4 Q. Right.

5 A. -- had biological impairment.

6 Q. I'll ask you the same question. Isn't it true that
7 nothing in the abstract of this article says that conductivity
8 or sulfate have caused or can cause any particular effects to
9 macroinvertebrates?

10 A. Frequently that is the kind of things in the discussion.
11 It is not in the abstract, you're correct.

12 Q. Now, is it fair to say that all the temperature data for
13 this article were taken in April?

14 A. I don't recall. I can look.

15 Q. I direct your attention to page 1830. There's a legend
16 on the left.

17 Mr. Tyree has it up.

18 A. It's on page 1830?

19 Q. I believe that's right. If not, Mr. Tyree can tell me.

20 A. Yes, I see that. "Chemistry and habitat variables shown
21 here are point values collected in April of 2011."

22 Q. Would it be fair to say also, if you turn to page 1833,
23 the second column -- Mr. Tyree has the full sentence --
24 beginning with "As expected."

25 A. "As expected, percent forest had moderate to strong

Palmer - Cross

1 negative correlations with biological indicators."

2 Q. And that means that as the percent of forest went down,
3 the biological indicators went down as well?

4 Is that a fair statement?

5 A. Well, it's pretty hard to separate forest from mining.
6 Yeah, percent forest goes down, it's usually because mining
7 goes up in these. That's correct.

8 Q. Did the authors not also find that the percent forest was
9 much higher at reference sites than at the mine sites?

10 A. I don't know. I'll look if you point me to where the
11 data are. I remember they were forested, but --

12 Q. Mr. Tyree, could you turn to page 1829, column one.

13 Dr. Palmer, Mr. Tyree has it up, if you want to see it,
14 on the lower left.

15 A. Eighteen --

16 Q. 1829, column one.

17 A. Percent forest was significantly higher at reference
18 sites, correct, even though other things like catchment area,
19 riffle substrate and so forth were comparable.

20 Q. All right. Did Pond not also say in this paper that his
21 valley fills did not encompass the full range of potential
22 source of mining impacts, such as chemical and sediment
23 loadings, or include data from streams draining newer fills
24 because his study was designed to evaluate fills associated
25 strictly with older fills?

Palmer - Cross

1 A. I don't know. If you'll point it out, I'll verify --

2 Q. Okay. Page 1834, Mr. Tyree, second column.

3 A. All right. Let's see.

4 Our valley fills did not encompass the full range of
5 potential sources observed across the region or include data
6 from streams draining newly constructed valley fills because
7 our study was designed to evaluate valley fills associated
8 strictly with older mountaintop mining operations.

9 Q. So Fola fills wouldn't fall in that category, would they?

10 A. I don't know their age. I should, but, no, they're
11 certainly not. They haven't been reclaimed in all this period
12 of time when these have.

13 Q. Mr. Tyree, would you go to page 1834, the first column,
14 last paragraph.

15 And, Dr. Palmer, this is a paragraph that starts
16 "Although only 2 out of." Do you see that?

17 A. This is 1834?

18 Q. Yes, I believe that's right.

19 A. Yes. "Although only 2 out of the 15 valley fill streams
20 were rated as unimpaired with GLIMPSS or observed to expected
21 (see Figure 5) we conservatively identified two additional
22 valley fill sites as 'nearly passing' GLIMPSS."

23 Q. All right. Now, the GLIMPSS, I think we heard earlier
24 testimony is more than just a finer tool. You think it's a
25 better tool.

Palmer - Cross

1 A. It is a better tool, yes.

2 Q. With that aside, it's also a harder test to pass, is it
3 not?

4 A. It is.

5 Q. Much harder.

6 A. It is.

7 Q. Okay. So the author here -- I think I'm saying this
8 correctly -- found that four out of the 15 sites either passed
9 or nearly passed the GLIMPSS.

10 These are the valley filled sites. So it's 16 valley
11 filled sites and four of them passed or nearly passed the
12 GLIMPSS, right?

13 A. I don't recall the total number, but, yes, some of them
14 nearly did. So they have numbers of just a little bit above
15 50, and 52 would be the passing. So they still failed it.

16 Q. Well, two passed and two almost passed.

17 A. Well, the ones that -- where I said a little above 50,
18 yes.

19 Q. Okay. If a WVSCI had applied, presumably all four would
20 have passed. Is that a fair statement? And maybe more.

21 A. Probably. But for those four, yeah.

22 Q. But he didn't use a WVSCI in the article to evaluate
23 them, did he?

24 A. I don't recall. I don't think he did.

25 Q. All right. And then, Mr. Tyree, if you could direct us

Palmer - Cross

1 to page 1837.

2 Dr. Palmer, there's a paragraph that begins with

3 "Specific conductance as a toxic stressor."

4 Do you see that?

5 A. Yes. "As a general matter, aquatic toxicologists do find
6 toxicity in ion rich waters, (Kunz et al. 2013), yet declared
7 that specific conductance alone is too coarse of a measure and
8 thus unreliable to predict toxicity as one cannot identify the
9 responsible toxic ions."

10 Q. Okay. So in 2014, Pond -- you may disagree with this
11 statement -- but nonetheless is saying that generally aquatic
12 toxicologists regard specific conductance as too coarse a
13 measure and believe that more works needs to be done to
14 identify the specific constituents that may be responsible for
15 the effects observed in the benchmark.

16 Is that a fair statement?

17 A. Yeah, that's because toxicologists tend to do WET tests
18 and use mortality measurements from those that have specific
19 ions isolated --

20 Q. I just asked a very simple question. Is that not what
21 Pond said in 2014?

22 A. My interpretation of what is in the paper is what I just
23 stated.

24 Q. Dr. Palmer, you testified earlier about Plaintiffs'

25 Exhibit 129, which is a 303(d) list, and I'm not going to go

Palmer - Cross

1 back to it. I am going to get another defense exhibit,
2 Defense Exhibit 196.

3 Your Honor, may approach?

4 THE COURT: You may.

5 BY MR. MCLUSKY:

6 Q. Dr. Palmer, I've handed you what's been marked as Defense
7 Exhibit 196 and ask if you can identify this as a letter to
8 Mr. Mandirola of the West Virginia DEP from EPA Region III,
9 dated May of 2012, which includes EPA's decision rationale for
10 the total maximum daily load for selected streams in the Elk
11 River watershed.

12 A. That appears to be what it is, yes.

13 Q. I'm going to direct your attention to page 3 of the
14 rationale document.

15 And Mr. Tyree has highlighted a sentence here, or a
16 paragraph.

17 Do you see where it says, "In certain waters"?

18 A. Yes. "In certain waters, the stressor identification
19 process determined ionic stress to be a significant stressor.
20 During the TMDL development period, there was insufficient
21 information available regarding the causative pollutants and
22 their associated impairment thresholds for TMDL development
23 for this pollutant. West Virginia DEP is deferring TMDL
24 development for biological impairments caused by ionic stress
25 and will retain those waters on the Section 303(d) list."

Palmer - Cross

1 Q. So here, DEP declined to use conductivity to regulate
2 ionic toxicity because specific causative pollutants had not
3 yet been identified, correct?

4 A. That was what DEP did, yes.

5 Q. Nor had the threshold of the specific substances that
6 might cause impairment been adequately developed either, were
7 they?

8 A. That is their opinion. It's not -- yes, I'm not saying
9 that there has not been evidence at this time. I'm saying
10 that DEP chose to interpret it that way.

11 Q. And EPA approved that approach in its decision document
12 approving the TMDL. That's what Exhibit 194 is, right?

13 A. I haven't read the whole thing, but I will take your
14 word. If this is accepting and deferring a TMDL, then that is
15 what it is.

16 MR. MCLUSKY: Your Honor, if I might have a minute,
17 I've got a big stack of articles and need to get some numbers
18 squared away.

19 THE COURT: That's fine.

20 BY MR. MCLUSKY:

21 Q. Dr. Palmer, Plaintiffs' Exhibit 137 I think is Pond 2012.
22 I got it chronologically out of order, and I apologize.

23 A. Okay. Yes.

24 Q. It's "Biodiversity loss in Appalachian headwater
25 streams."

Palmer - Cross

1 A. Correct.

2 Q. I think you testified about this earlier.

3 A. I did, yes.

4 Q. I'll ask you here again is it fair to say that the
5 abstract, despite noting a correlation between conductivity
6 and impacts, does not state that conductivity nor sulfate can
7 or have caused any particular impacts to aquatic life
8 anywhere?

9 A. The O/E index was highly correlated with habitat and
10 chemical stressors, including conductivity.

11 But, yes, it doesn't say "causal effect." It doesn't use
12 those words.

13 Q. Right. And in 2008 he found a high degree of correlation
14 with RPB factors and multi-metric indices, right?

15 A. We can look back at that paper if you want me to verify
16 that.

17 Q. Well, that's the .74 correlation coefficient. Remember
18 that?

19 A. I do.

20 Q. Turning back, then, to the Pond 2012, second column of
21 the abstract, doesn't the author say that the -- see this
22 highlighted segment, "The O/E index was highly correlated with
23 individual habitat"?

24 A. That's what I just read. Yes.

25 Q. Okay. Sorry. That's the observed/expected?

Palmer - Cross

1 A. Correct.

2 Q. Okay. And what that means, the bugs you found versus the
3 bugs you expected is some type of metric that --

4 A. Yeah, usually you're comparing it to what you find in
5 reference streams. That's your expectation. You're comparing
6 what you observed to that.

7 Q. So whatever this index is, then, it bore a high degree
8 of -- a high correlation to individual habitat, correct?

9 A. It says it is highly correlated, yes.

10 Q. Joint Exhibit 11, which I think is the Merriam, Petty
11 additive effects paper you testified about.

12 A. Okay.

13 Q. I take it it's also true that in the abstract of this
14 article, there's no claim that conductivity or any of its
15 constituents caused WVSCI impairment.

16 A. So they state in the abstract that mining was strongly
17 associated with acute changes in water chemistry, whereas
18 residential development was affected by habitat, but it
19 doesn't mention acute water chemistry for habitat.

20 They're primarily looking at the type of land use and the
21 effect that that has on the bugs, but they are also looking
22 at, you know, what potentially is underlying that by looking
23 at other factors.

24 Q. Could you look at page 407 of that article? And I don't
25 have the exhibit page.

Palmer - Cross

1 A. Okay.

2 Q. I'm waiting for Mr. Tyree to catch up.

3 Page 407, Mr. Tyree, if you could. Joint Exhibit 11 is
4 the Merriam and Petty paper.

5 Dr. Palmer, can you confirm for your lawyer this is the
6 2011 paper?

7 A. Where are you in this on that page?

8 Q. Well, let's go to page 407.

9 A. Okay. I'm on 407.

10 Q. The first full paragraph.

11 A. On the left, okay, "Residential development."

12 Q. "In addition, macroinvertebrate communities," do you see
13 Mr. Tyree has highlighted on the screen?

14 A. Yes. "In addition, macroinvertebrate communities were
15 significantly altered along the residential gradient."

16 Q. So, here, bug scores, or whatever measurement they chose
17 to make of the insects, significantly changed as there was a
18 change in residential development.

19 Is that a fair statement?

20 A. It's well-known they both influence the invertebrates.
21 What is significant is mining and residential development had
22 additive effects.

23 Q. Right. But the residential development, was that
24 caused -- did they contribute to conductivity or was it just
25 land disturbance?

Palmer - Cross

1 A. They didn't -- I don't recall that they came up with a
2 specific -- probably, since it was the abstract, pointed
3 towards habitat. My guess is it may have been more related to
4 habitat. Siltation is common when you have residential
5 development, heavy siltation.

6 Q. Mr. Tyree, if you would go to page 409, column two,
7 please.

8 Dr. Palmer, look in column two. Can you confirm -- I may
9 have misread this -- that the linear relationship the author
10 has found between the WVSCI and conductivity had an R square
11 value of .36?

12 A. That's correct.

13 Q. And that means that the line they drew through the data
14 did not explain some 64 percent of the variability in the
15 data?

16 A. It means it explained 36 percent, and it is significant
17 at the .035 level, which is highly significant.

18 Q. Didn't explain a whole lot of the data variability.

19 A. It explained a significant amount of the data. That's
20 why earlier when you were pointing to correlation
21 coefficients, I said I'd have to see some sort of regression
22 and P value, because you can have high correlation and an
23 insignificant slope.

24 Q. Let's turn to Joint Exhibit 1, which is Bernhardt and
25 Palmer, "The environmental costs of mountaintop mining."

Palmer - Cross

1 2011, I believe.

2 A. I'm sorry. Joint Exhibit?

3 Q. I have Joint Exhibit 1, actually. But my handwriting was
4 getting a little sloppy late last night.

5 A. Okay.

6 Q. And I think you said earlier this was -- original
7 research was not done for this. This was more of a survey of
8 other research --

9 A. It was more of a synthesis.

10 Q. All right. Would you turn to page 45 of the article.

11 A. Yes.

12 Q. And I believe there's a statement that starts with,
13 "Mining also leads to significant changes." Could you read
14 that, please?

15 A. "Mining also leads to significant changes in watershed
16 hydrographs. Recent work analyzing hydrological changes as a
17 function of the amount of a watershed that has been surface
18 mined showed that peak flows increase linearly with the
19 percent of the watershed mined, even if the land has been
20 reclaimed."

21 Q. If you could go on and just read the rest of that
22 paragraph?

23 A. "These hydrologic changes persist because reclamation
24 using earth-moving machinery compacts soil layers thus
25 decreasing porosity and water infiltration. Compared to

Palmer - Cross

1 regions that have not been mined, infiltration may be as much
2 as an order of magnitude lower so that mined sites respond to
3 rainfall more like urban watersheds, where impervious surfaces
4 lead to high surface runoff during storms."

5 Q. And you have found, I think from some of your own
6 research, when there are large changes of hydrologic signals,
7 that there are significant changes in macroinvertebrates below
8 those areas, haven't you?

9 A. It's totally dependent on the relationship between the
10 change in peak discharge and the bottom geomorphology, the
11 sediment composition. If you don't have bed mobilizing flows,
12 if the peak flow doesn't increase significantly to mobilize
13 the bed, then the flow is not a significant disturbance.

14 Q. Well, is a peak flow that increases linearly with the
15 percent of watershed mined significant? It seems to me it is.

16 A. It could be a significant increase statistically but not
17 biologically unless it mobilizes the bed.

18 Q. Where does it say that in this article?

19 A. It doesn't go into that level of detail.

20 My degree in oceanography was because I studied hydrology
21 and the relationship between benthic organisms in marine
22 sediment. So it's an area I know pretty well.

23 Q. Did you do any work here on whether there had been a
24 change in the peak flows off this site as a result of mining?
25 That is, did the peaks either increase as a result of mining

Palmer - Cross

1 or did they actually decrease as a result of mining?

2 A. The Fola case?

3 Q. Yes.

4 A. I have not looked at changes in discharge pre and post
5 except it is -- some of those information are in our report.
6 The problem is, we don't know if the sites always match up.
7 You can't really analyze that.

8 Q. Mr. Tyree, would you turn to page 48 of the article,
9 column one?

10 And I think you probably said this earlier, but the
11 article I think says that tests for conductivity toxicity for
12 mayflies have often proved inconclusive.

13 Is that a fair statement?

14 A. Yes. And this is relevant to when you kept bringing up
15 the food web effects of metals and so forth, like selenium.
16 Yeah, it gets concentrated in the food web, but they have a --
17 for many of these organisms at this point, they hadn't
18 necessarily been related to toxicity.

19 Q. Things like selenium getting in the food web?

20 A. I don't -- to my knowledge, at this point they had not
21 been related to like LD50s or something like that in mayflies,
22 that's correct.

23 Q. Mr. Tyree, go to page 49, column one.

24 Dr. Palmer, Mr. Tyree has highlighted some language on
25 page 49. Could you read that for us?

Palmer - Cross

1 A. "To date, there have been studies that explicitly link
2 the cumulative extent of mountaintop mining to the water
3 quality and biological community structure of impacted
4 streams."

5 Q. I think you said -- did you say "no studies"?

6 A. I'm sorry. Yeah.

7 Q. It says "no studies."

8 A. That's correct.

9 Q. And this is your article written in 2011?

10 A. That's correct. The Bernhardt paper wasn't published at
11 that point.

12 Q. Let's turn to Joint Exhibit 2, which is Bernhardt et al.,
13 "How Many Mountains Can We Mine?"

14 A. Yes.

15 Q. All right. Mr. Tyree, can you get that up, please?

16 Turn to page G of Joint Exhibit 2.

17 A. Okay.

18 Q. Page G, Mr. Tyree.

19 Can you confirm that the "How Many Mountains" paper was
20 supported by gifts from the Sierra Club and Appalachian
21 Voices?

22 A. That's what it says here.

23 Q. Okay. Now, as I understand it -- let's go back to
24 page C, please, Mr. Tyree.

25 What were the statistical techniques that were used here

Palmer - Cross

1 by the authors?

2 A. I'd have to go back and review it again. I didn't write
3 this paper. I wasn't involved in it.

4 Q. Are you aware that they used the general additive
5 regression models?

6 A. That's my understanding, that it talks about GAMs in
7 here --

8 Q. Okay.

9 A. -- but I didn't do the analyses.

10 Q. If you'd go to page F, Mr. Tyree.

11 Dr. Palmer, is it fair to say, if you look in the first
12 column -- Mr. Tyree has it highlighted -- that based on the
13 GAM models, once a stream conductivity increases above 121 or
14 308 microsiemens, GLIMPSS and WVSCI scores will typically fall
15 below their respective impairment thresholds?

16 A. That's what it says here.

17 Q. So if I read this right, if conductivity increases above
18 121, I would typically --

19 A. Have a failing --

20 Q. -- fail, fail the GLIMPSS score.

21 A. That's what it implies, yes.

22 Q. Okay. Do you know what background is in West Virginia
23 for conductivity?

24 A. It's highly variable, depending on where you are. So it
25 can be as low as 50 and it can be as high as a little over

Palmer - Cross

1 300.

2 Q. Hasn't -- didn't Suter and Cormier in the benchmark
3 actually look at and calculate a background level?

4 A. I could look at it and determine that.

5 Q. Well, Mr. Tyree, could you put up Joint Exhibit 3, which
6 is the Suter and Cormier "Derivative of a benchmark" article?
7 Turn to page 268.

8 A. Which exhibit is this?

9 Q. This is Joint Exhibit 3.

10 A. Okay.

11 Q. And I have pages 268 of the article, and I think it's
12 page 76 maybe on the exhibit. You'll see we exhibited, "We
13 also estimated the background of conductivity."

14 Do you see that?

15 A. I do, yes.

16 Q. Is it fair to say that if you go over on page 269 of the
17 article, when they combine those numbers, they come up with a
18 background level of conductivity of 150 microsiemens?

19 A. That's what it says, yes.

20 Q. So the background level in West Virginia, according to
21 "How Many Mountains Can We Mine," would flunk a GLIMPSS.

22 Is that a fair statement?

23 A. No, it's not a fair statement. My understanding,
24 although I would have to read the full article, that again the
25 GAM was not used to identify the threshold. It was the TITAN

Palmer - Cross

1 that they used to identify the threshold. So their
2 conclusions based on GAM in that sentence are nothing that I
3 would support.

4 Q. What threshold did they use using TITAN for a GLIMPSS?
5 Do you know?

6 A. I don't know. I could look and see if it's in there.

7 Q. Turn to Joint Exhibit 4, which is Cormier et al.,
8 "Assessing causation of extirpation."

9 A. Yes.

10 Q. And I think -- did we go over this one earlier too?

11 A. I think we did real quickly, yes.

12 Q. Mr. Tyree, could you -- well, first of all, was there any
13 effect modification analysis done by Suter and Cormier?

14 A. You know, I think that they sort of combined confounding
15 and effect modification is my recollection.

16 Q. Mr. Tyree, go to page 286, top paragraph.

17 Dr. Palmer, can you read the first sentence on page 286?

18 A. "This causal assessment does not compare the relative
19 importance of ionic-induced extirpation of genera in
20 Appalachia with other known stressors in the region such as
21 metal toxicity, stream bed siltation, or eutrophication.
22 Instead, it determines that addition of the ionic mixture to
23 streams can and does cause extirpation of aquatic
24 invertebrates."

25 So they're basically pointing out that they use streams

Palmer - Cross

1 that go the full range of all these things that vary and so
2 forth and they still found a relationship.

3 Q. They made no effect in any of these papers -- no attempt
4 in any of these papers to try and parse out what particular
5 constituent or constituents of conductivity may be
6 contributing or causing to the absence of sensitive insects.

7 A. That was not their goal, and, in fact, they explicitly
8 set out to include the full range of what goes on in the real
9 world, which is why they didn't rely on laboratory toxicity
10 tests.

11 When you get an effect like this on top of the
12 variability and lots of potential stressors, it's surprising.

13 Q. Mr. Tyree, could we go to Joint Exhibit 5, which is
14 another Cormier paper, "A Method for Assessing the Potential
15 for Confounding."

16 And I think we went over this one too, Dr. Palmer.

17 A. We did quickly, yes.

18 Q. You had -- and I lost track of the exhibit number -- but
19 a regression line taken from the benchmark document.

20 Do you recall Mr. Lovett had that?

21 A. I don't recall. Sorry.

22 Q. I think that's the one you used to say that there was a
23 probability of -- a 72 percent chance of not passing the WVSCI
24 score --

25 A. I read directly from the benchmark that, yes.

Palmer - Cross

1 Q. Now, you're not suggesting that regression line proves a
2 causal relationship, were you?

3 A. The causal relationship was proven by the causal
4 assessment, not by a single regression line.

5 Q. Okay. Joint Exhibit 8, which was the Hitt and Chambers
6 temporal changes in --

7 A. Yes.

8 Q. -- fish --

9 A. Assemblages, yes.

10 Q. To make sure I understand here, didn't water quality in
11 this case exhibit elevated selenium levels?

12 A. I don't recall, and I don't recall over what time period
13 because they had data from a long time ago from another study.
14 They had contemporary data and looked at seasonal data,
15 contemporary.

16 Q. Mr. Tyree, could you go to table 1 in Joint Exhibit 8.

17 Dr. Palmer, Mr. Tyree has up table 1. Do you see that?
18 I'm afraid I don't have the page.

19 A. No, I do see there are high levels of selenium.

20 Q. Don't you think that should have been discussed in any
21 discussion about potential effect of conductivity on fish?

22 A. That's a good question. You know, most of the work on
23 selenium in fish has looked at sublethal effects, not the
24 entire disappearance of fish. So if you look at the work
25 that's been done by people associated with USGS and other

Palmer - Cross

1 groups, U. S. Fish and Wildlife, severe abnormalities, curved
2 spines, somewhat reduced reproduction, but I don't know that
3 there are studies of direct mortality of fish that they would
4 want to use to infer the really significant changes. It's
5 also not clear why -- well, I'll stop there.

6 Q. Is it fair to say that Dr. Hitt did not claim there was a
7 causal relationship between either conductivity or any change
8 in the benthic makeup in fish populations; did he?

9 A. You mean did he use the word "causal"? Is that what
10 you're asking?

11 Q. Yes.

12 A. I can look and see. I suspect he may not have used that
13 word "cause," but there's a lot of ways to talk about the
14 relationship between dependent and independent variables
15 without using that word.

16 Q. Well, an easy way is to use the word, isn't it?

17 A. Well, actually ecologists don't typically use that word.
18 So this is something that I'd have to get used to. It's more
19 of a toxicological kind of thing, causal.

20 Q. Does he not say additional research is necessary to
21 assess how reduced diversity of macroinvertebrate assemblages
22 affects the total biomass and how that affects prey selection
23 by fish?

24 A. Oh, of course. But he also said that the invertivores
25 were dramatically reduced. The functional group composition

Palmer - Cross

1 changed.

2 Q. But he doesn't attribute that to any particular thing.
3 He says it's simply within -- the conductivity was within a
4 range that one might expect a change --

5 A. He also said -- he talked about reduced invertebrates.

6 Q. Now, he had less fish numbers but more -- he had bigger
7 fish, didn't he?

8 A. Right, because he had, as I recall, things like sunfish
9 and things you might not necessarily expect in reference,
10 unimpacted sites. These are more tolerant species.

11 It's sort of like, you know, getting big rats instead of
12 chipmunks in areas that are urbanized, more biomass, but you
13 don't necessarily want the rats.

14 MR. MCLUSKY: Your Honor, may I have just a minute?

15 THE COURT: Yes.

16 BY MR. MCLUSKY:

17 Q. Dr. Palmer, you are aware, of course, that Dr. Hitt is
18 married to Mary Anne Hitt, who is head of the Sierra Club's
19 Beyond the Coal Campaign?

20 A. I had no idea, no.

21 Q. Should something like that be noticed in an article,
22 someone is working for the U. S. Government that draws half
23 their -- or maybe half of their revenue from the Sierra Club?
24 Shouldn't that be noted?

25 A. I don't know. I mean, I write about fish sometimes in my

Palmer - Cross

1 papers and I don't say my husband works for the American Sport
2 Fishing Association. It doesn't imply bias.

3 MR. MCLUSKY: Your Honor, I think I'm finished.

4 THE COURT: All right. Redirect?

5 MR. LOVETT: Yes, Your Honor. I'm afraid it's going
6 to take a little while because we're going to have to go
7 through those articles that Mr. McLusky just went through and
8 I think cherry-picked some quotations and I may have to
9 counter. I'll be happy to start --

10 THE COURT: So you want to pick some cherries
11 yourself?

12 All right. I understand. All right. Well, we'll pick
13 up tomorrow morning. Just, generally speaking, how does
14 plaintiff perceive you're doing with the number of witnesses
15 you have and the time we've taken thus far?

16 MR. LOVETT: I think we're fine, Your Honor. I
17 think we'll finish Dr. Palmer pretty quickly tomorrow and then
18 one short witness and then a longer witness and then we'll be
19 finished. And I hope we can finish all that tomorrow. And
20 then --

21 MR. MCLUSKY: We have one witness.

22 THE COURT: Dr. Menzie?

23 MR. MCLUSKY: Yes.

24 MR. LOVETT: So the goal is to finish on Thursday.

25 THE COURT: That would be wonderful. All right. So

1 we'll adjourn until 9:00 a.m. tomorrow.

2 You can step down. Don't talk about your testimony.

3 All right. We stand adjourned until tomorrow morning.

4 (Proceedings adjourned at 5:20 p.m.)

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1		I N D E X			
2	<u>Plaintiffs' Witnesses</u>	<u>Direct</u>	<u>Cross</u>	<u>Redirect</u>	<u>Recross</u>
3	STEVEN WING	4	55	78	--
4	MARGARET PALMER	81	197		
5					
6	<u>Joint Exhibit</u>	<u>Admitted</u>			
7	No. 17	3			
8					
9	<u>Plaintiffs' Exhibits</u>				
10	No. 72	6			
11	No. 167	55			
12	No. 170	55			
13					
14	<u>Defendant's Exhibits</u>				
15	No. 19	3			
16	No. 38	3			
17	No. 43	3			
18	No. 30	3			
19	No. 45	3			
20	No. 32	3			
21	No. 46	3			
22	No. 33	3			
23	No. 47	3			
24	No. 34	3			
25	No. 48	3			

1	No. 39	3
2	No. 36	3
3	No. 40	3
4	No. 35	35

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21 I, Teresa M. Ruffner, certify that the foregoing is a
22 correct transcript from the record of proceedings in the
23 above-entitled matter.

24

25 /s/Teresa M. Ruffner

August 12, 2015